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Development of smart bed prototype

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ABSTRACT

Nowadays, almost every household has several alarm clock devices. Many people choose their morning wake up routine with all-in-one devices because of the freedom offered by today's technology like mobile phone or other portable clock. However, the issue of overslept still arises in our community. This is due to the fact that the current alarm clock is simple to disarm and also have a snooze button that will make the user possible to sleep again. Therefore, this Smart Bed prototype is designed to overcome problems of overslept. Furthermore, this project also can help those with hearing impairments where they can't hear the alarm sound. The main objective of this project is to design a prototype of Smart Bed to help people who have problems waking up at the designated time. This prototype uses Arduino as the processor part. This project includes the alarm itself and also connected to the vibrator and the water sprinkler circuit. The vibration in the bed and then sprinkle of the water will cause the user to feel uncomfortable to sleep and get them to wake up.

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Introduction

Alarm clock is very important in our daily lives. The alarm clock has been used for a long time. It intended to make a sound, or other sign at a particular time. The main purpose of alarm clock is to wake people up from their night's sleep or a short nap. The alarm clock is also sometimes used for other purposes as well. Most alarms sound and some use light or vibration. Some have sensors to recognize when a person is at rest. To stop sound or light, the alarm is pressed. Due to that the alarm will stop from continuing to emit sound or light.

There are many alarm clocks available nowadays such as traditional mechanical alarm clock and digital alarm clock. The traditional mechanical alarm clock has one or two bells ringing in a mainspring manner that moves the gear to move the hammer back and forth between the two bells or between the parts in a single bell as shown in Figure 1. The first mechanical alarm clock was invented in 1787 by Levi Hutchins, of New Hampshire in United States (Kasim. S. et al, 2016). Traditionally, alarm clocks are simple mechanical devices and used to wake up people from their sleep.

Figure 1 <Traditional Mechanical Alarm Clock>
(resource: https://www.flipkart.com/)

Figure 2 <Digital Alarm Clock>
(resource: https://paytmmall.com)

In Figure 2, show an example of digital alarm clock. This type of alarm clock can make different sounds and also can play a song as alarm. This digital alarm clock normally use battery as it power supply. It usually used either as a wake-up call or as a reminder to do our daily chores. Usually in almost every household there are some forms of alarm clock devices. An alarm is a clock that aims to make a sound, or other sign at a designated time but with the current era of technological advancements, we have phones and mobile phones with alarm capabilities in place. These developments benefit the general public in their daily lives

Most alarm clocks have sound and some use light or vibration (Sreenivasulu T. et al , 2018). Some have sensors to recognize when one is at rest. However, the cases of overslept is still arise (KE Lee et al. 2015). As a result, some of us will be absence of the classes, meetings, and even exams (Kasim. S. et al, 2016). By referring to Vishnu et al. (2018), there are 4 downside of alarm clock that are sleep anxiety, stress, social jetlag and bright light. Therefore, the idea to designed Smart Bed prototype has come out. This project is created to help people who are having trouble getting out of bed at a designated time and also can help people with hearing problems or people who are sick like having sleep disorder (Tampere University of Technology, 2008). This is because, this Smart Bed not only have an alarm, it has also water sprinkler and vibrator circuit built in the bed.

Method

Basically, this Smart Bed prototype consists of three main parts as shown in Figure 3. That are input, process and output. The input part consists of 5 volts direct from the dc power supply. Then, Arduino will be the main part of the process. Then, there were three output for this prototype: buzzer, water sprinkler and vibrator.

The Arduino UNO board has been the heart of this project as shown in Figure 4. 5v power supply is used to operate it. The board is equipped with a set of digital and analog pins input and output that can be connected to various expansion boards (shields) and other circuits. The brain of this Arduino UNO is ATmega328P microcontroller chip (Nussey J. 2018). The board has a serial communication interface, including Universal Serial Bus (USB) on some models, which is also used to load programs from personal computers. The microcontroller is usually programmed using feature dialects from the C and C ++ programming languages.

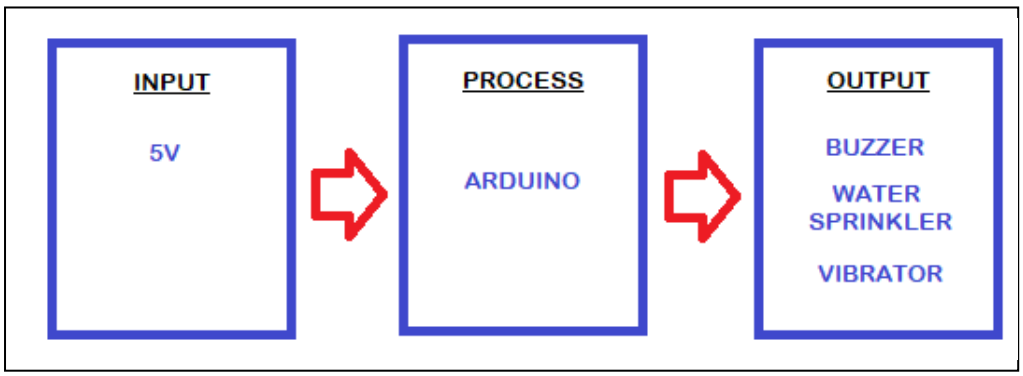

Figure 3 <Block Diagram of Smart Bed>

In addition to using traditional regulator tools, the Arduino project provides an integrated development environment (IDE) based on the Processing language project. It has been programmed using Arduino IDE software has in the language of programming. In this software, the time and output have been set. Then, it will contact to the relay circuit as shown in Figure 5 to connect to the output.

Figure 4 <Arduino UNO>
(resource: https://www.dummies.com/computers/arduino/getting-to-know-the-arduino-uno/)

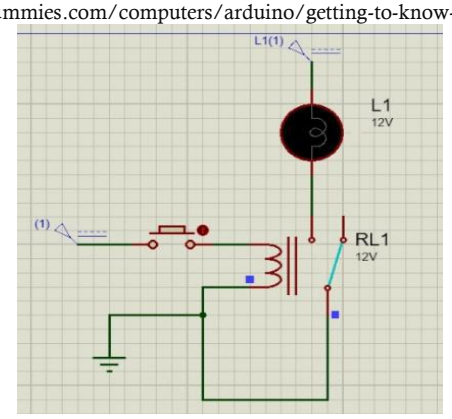

Figure 5 <Relay Circuit>

As refer to Figure 6, the flowchart show how the Smart bed is operated. The first step is user must set the timer when they want the alarm to be ON. Then, this process will make the buzzer is in ON condition. It will sound when the timer reaches the time setting in the Arduino just like normal alarm clock. Then the second and third output are water sprinkler and vibrator. Both output will be functioning 10 minutes after the alarm sound if the user didn't stop the buzzer. It means that user still didn't wake up from a sleep. The water sprinkler will flash water at the user and simultaneously the bed will vibrate. This process will keep doing until the user wake up and click the STOP button.

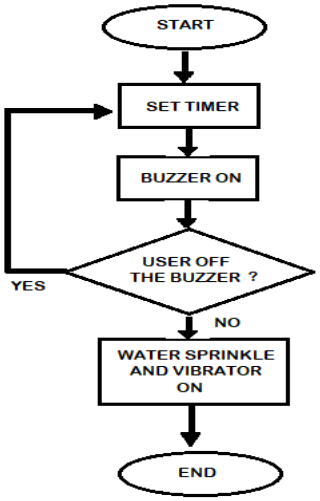

Figure 6 <Flowchart of Smart Bed>

Results and Discussions

Figure 7 show the design of Smart Bed prototype. All the electronic part will be installed underneath the bed with three output buzzer, water sprinkler and vibrator after all the programming for the system has been done. In this work, two cases were identified to make sure the project is successful. One cases with buzzer and cases two with buzzer and water sprinkle.

Figure 7 <Smart Bed prototype>

The buzzer is sound when the timer reaches the setting time. Then it will buzz until 10 minutes. If the user has woken up and the STOP button is released, the buzzer will stop buzzing. If not, there will be case 2, that is the water sprinkler and the vibrator will function. Water sprinkler will flash the water to the user and the bed start vibrate. As a result, the user will wake up when they feel uncomfortable of the vibration on the bed and the spray of water to them. Actually, this also will help disable person who has problem in hearing the alarm sound.

Table 1 : Configuration of the cases

Case	Output	Condition	Action	Explanation
1	Buzzer	ON	Sound	When timer reaches the setting time
2	Water sprinkler	ON	Flash water	When the user still not wake up
	Vibrator	ON	Bed vibrate	

Conclusions

Based on our research for this Smart Bed prototype, this product is very useful, especially for those who have problem to wake up from sleep as it has three styles for wake up user. Furthermore, the electronic part is also suitable for real product and it very affordable to build it. We just need to change only the vibrator part to make it more realistic. Besides, it is good for those whose have hearing impairment and people who have slept disorder problem.

Acknowledgments

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