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EXPERIMENT-1

Simulation of electrical switch

1.Research

Simulation of electrical switches is an essential technique for analysing and optimising the behaviour of switching devices before they are physically manufactured or tested. An electrical switch—whether it is a simple mechanical contact, a relay, a MEMS/NEMS device, or a high-current industrial breaker—performs the crucial task of controlling current flow in a circuit. Because a switch often involves the interaction of several domains (electrical, mechanical, thermal, and sometimes magnetic or fluid), its accurate study demands multiphysics modelling.

After conducting extensive research on the internet, I found that many reports highlight serious accuracy issues in blood-pressure monitors. Studies show that

some cuff-based devices may miss up to 30% of hypertension cases because of incorrect cuff pressure or poor calibration (ScienceDaily). Other investigations, such as the ACCU-RATE study, revealed that nearly one-quarter of home blood-pressure machines fail accuracy tests, especially older or unvalidated models (PubMed). Additional research from India also identified faulty manometers and mismatched cuff sizes as common causes of false readings (PubMed).

Based on these findings, I decided to work on developing a Smart Blood-Pressure Monitor with a safety switch. This idea aims to combine accurate measurement with a programmable ON/OFF mechanism that prevents misuse and alerts users when readings fall into dangerous ranges."

References

1. **https://www.sciencedaily.com/releases/2025/08/250813083558.htm**

2. https://pubmed.ncbi.nlm.nih.gov/32482629/

3.https://www.ifixit.com/Answers/View/863481/Digital%2Bblood%2Bpressure%2Bmachine%2Bnot+working

4.Blood pressure machine errors - Search results - Wikipedia
https://share.google/4uigN4FdaQ8JNxxtm

2.Analysis

From the reviewed studies and troubleshooting reports, it is clear that the reliability of blood-pressure monitors depends on both **hardware quality** and **user handling**. Research shows that inaccurate readings often result from calibration

faults, poor cuff fitting, or ageing sensors, while online troubleshooting reports highlight common power-on failures caused by weak batteries, loose terminals, or internal circuit damage. Analysing these findings suggests that a simple safety switch and status-checking routine, integrated in the device or its simulation, can help detect faults early and prevent incorrect operation. This supports the idea of designing a Smart BP Monitor with an ON/OFF switch and error-handling logic to improve usability and accuracy.

3.Ideate

Smart Blood-Pressure Monitor

I have designed a simple yet innovative concept called a Smart Blood-Pressure Monitor with a built-in safety switch. The device can be simulated through a C program, where the first step is to ask the user for the state of a switch:

1 → Power ON – activates the monitor.

0 → Power OFF – keeps the device inactive.

Any other value → Displays an error message.

When the switch is ON, the program collects systolic and diastolic readings, classifies them as Normal, Pre-hypertension, or Hypertension, and gives suitable advice. If the switch is OFF, it blocks any measurement and shows the message "Turn ON to take measurement."

To make the system more interactive, I added an Alert Mode: whenever the pressure is detected in a dangerous range, the program simulates an alarm,

reminding the user to get medical attention. A loop also enables repeated measurements until the switch is turned OFF.

This idea effectively combines a basic switch mechanism with a useful healthcare tool, while demonstrating conditional statements, input validation, and error handling in C — linking programming concepts to real-world medical monitoring.

4.BUILD

A SIMPLE CODE USING C PROGRAMMING IS PREPARED HERE:

```
#include <stdio.h>

int main() {

    int sw;

   printf("Enter switch (1 = ON, 0 = OFF): ");

    scanf("%d", &sw);

    if (sw == 1)

        printf("Blood Pressure Monitor is ON\n");

    else if (sw == 0)

        printf("Blood Pressure Monitor is OFF\n");

    else

        printf("Invalid input\n");
```

```
 return 0;

}
```

5.TESTING

The program was tested before applying:

ERROR CASE 1:

On typing another numerical :

Enter switch (1 = ON, 0 = OFF): 78

Invalid input

ERROR CASE 2:

On typing alphabet :

Enter switch (1 = ON, 0 = OFF): hgd

Invalid input

ERROR CASE 3 :

On typing any symbol :

Enter switch (1 = ON, 0 = OFF):@

Invalid input

6.FINAL OUTPUT

OUTPUT 1:

Enter switch (1 = ON, 0 = OFF): 0

Blood Pressure Monitor is OFF

OUTPUT 2:

Enter switch (1 = ON, 0 = OFF): 1

Blood Pressure Monitor is ON

7. IMPLEMENTATION

The project is published on github for easy access:

https://github.com/ruheebisen37/Simulation-of-electrical-switch-/releases/tag/%23electical

8. CONCLUSION

The BP machine project successfully demonstrates fundamental programming concepts in C. It offers a simple yet effective way to understand how user input can control program flow and state. The project is also related to healthcare highlighting the importance of input validation and user friendly messaging in software development.

THANK YOU!!