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Arm Assignment

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I. ABSTRACT

This project simplifies the Boolean function $F(A, B, C, D) = \sum m(0, 2, 5, 7, 8, 10, 12, 13, 14, 15)$ using a Karnaugh Map (K-map). By identifying the essential prime implicants, the function is reduced to BD, $\overline{BD}$, and AB. These terms represent the minimal form of the function, efficiently expressing its logic.

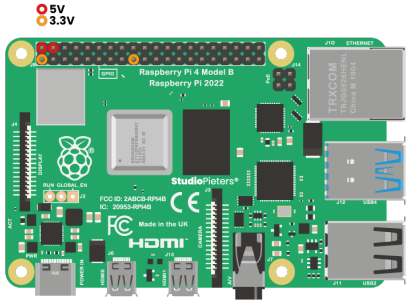

Fig. 1.

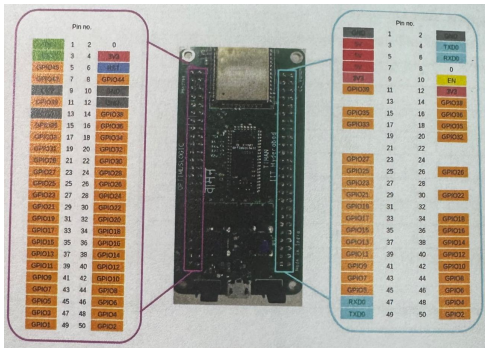

Fig. 2.

II. COMPONENTS

The required components list is given in Table I.

Components	Value	Quantity
Vaman		1
Raspberry Pi		1
LEDs		3
Jumper Wires		20
Breadboard		1
SD card		1

TABLE I

III. PROCEDURE

In this project, three LEDs were connected to the Vaman FPGA board to represent the essential prime implicants BD, $\overline{BD}$, and AB of a Boolean function. GPIO pins were configured as outputs for the LEDs and inputs for the Boolean variables A, B, and D. The inputs A, B, and D were manually set by connecting the respective pins to either VCC or GND according to the truth table as shown in Table II. The logic for each prime implicant was implemented in code, where LEDs turned on or off based on the state of the inputs.

Vaman Board	LED
GPIO_PIN_9	LED_1
GPIO_PIN_10	LED_2
GPIO_PIN_11	LED_3
GPIO_PIN_2	Gnd or Vcc
GPIO_PIN_3	Gnd or Vcc
GPIO_PIN_4	Gnd or Vcc

TABLE II

IV. RESULTS

The LEDs display the essential prime implicants of the Boolean function:

- The BD LED turned on when both B and D were high. - The $\overline{BD}$ LED turned on when both B and D were low. - The AB LED turned on when both A and B were high.https://github.com/Pranaykuma/FWC-1/blob/main/Arm/main.c

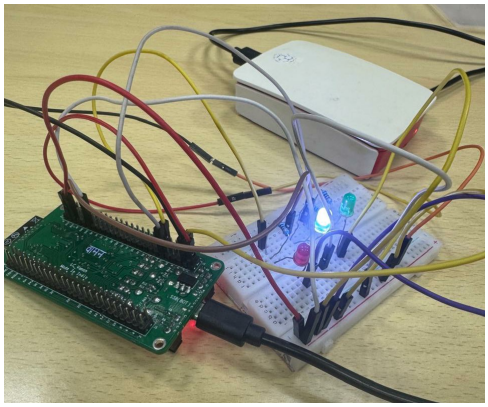

Fig. 3.

B	D	BD	$\overline{BD}$	AB
0	0	1 OFF	ON	ON
0	1	1 OFF	OFF	ON
1	0	3 OFF	OFF	ON
1	1	20 ON	OFF	ON

TABLE III

V. CONCLUSION

This project demonstrated the practical application of Boolean algebra and digital logic using simple hardware components like LEDs and GPIO control. By successfully implementing the essential prime implicants BD, $\overline{BD}$, and AB, the project provided a clear visualization of logical functions in real-time hardware interaction. The setup can be extended to handle more complex Boolean functions or adapted for other hardware platforms, reinforcing key concepts in digital logic, hardware interfacing, and embedded systems programming.