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Q.2) I have connected the output of the sensor to an opamp. Opamp is open loop with $A_{OL} = 10^5$.

I have passed the output of the sensor to the ~~+~~ve end and 1.860 mV that is voltage of the sensor at 30% Humidity to the +ve end through a battery.

Now, if the humidity $> 30\%$, output of the opamp reaches $-5V$, otherwise $+5V$.

I have passed this output to the base of the BT with +ve threshold voltage. It is on when the opamp output is $+5V$ that is when the humidity is $\leq 30\%$ and the fan is on with a.c. $230V, 50Hz$ from the mains. When the humidity $> 30\%$, opamp output is $-5V$, \therefore BT is off, fan is off.

I have also passed $+5V$ supply to the sensor. For that, I have used a rectifier (a.c. to d.c.) and a regulator (buck converter) which steps down the d.c. (50V) from the rectifier to 5V. I have passed this to the opamp too where required (inverter is used for max possible input the -ve part).

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Assumptions : Motor speed 200, 50Hz without noise.
Fan should be on at 20% Humidity.

Trade off : Using the buck converter as a regulator reduces efficiency.