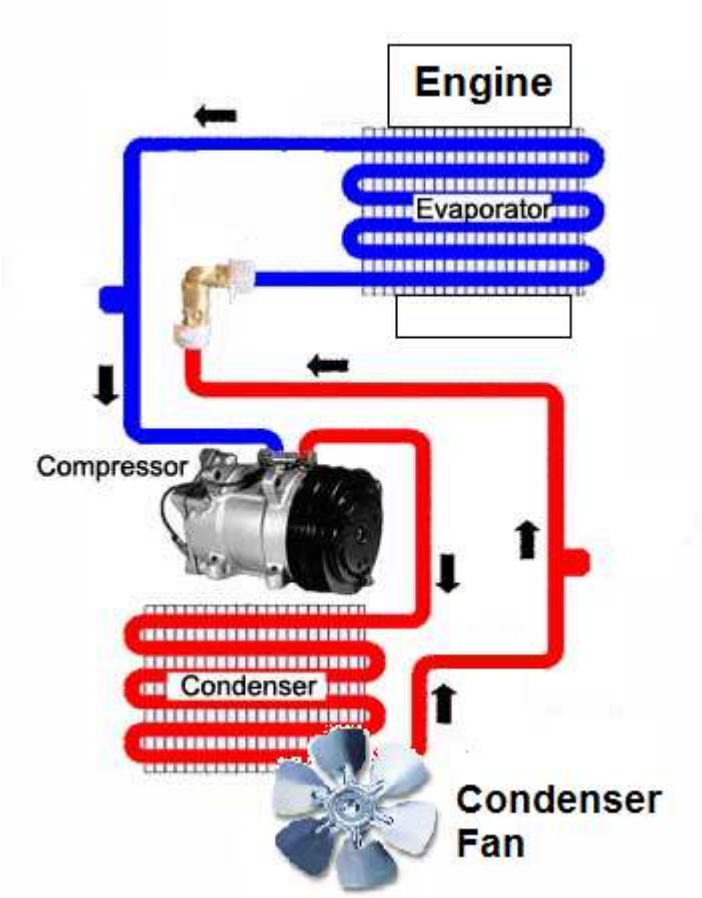
1- State the main elements of an automated system and explain each one of them giving examples.

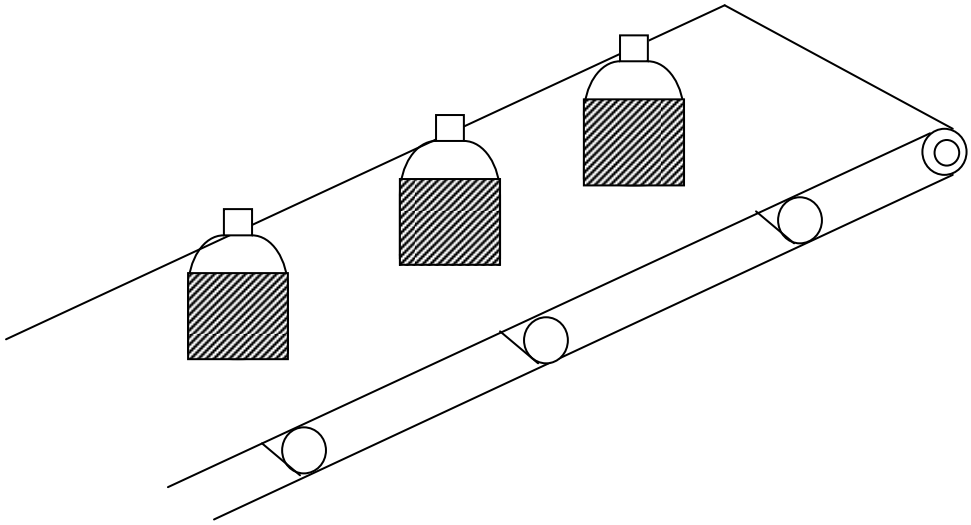
2- Explain the different types of automated subsystems. Give practical examples.

Design a relay logic circuit that satisfies the following applications. Your design should include power and control circuit.

1- The cooling system of an engine is shown in figure consists of a compressor (3 phase induction motor) and a radiator fan (DC Motor). The cooling system is switched on and off via a start/stop push button. The starting current of the compressor is $\frac{1}{\sqrt{3}}$ rated current for 2 seconds and then operates at rated current. A sensor detects the condenser temperature, the sensor is represented as a switch which is closed when the condenser temperature is above a critical value. The fan will be automatically switched on if the temperature rises.



2- The conveyer belt shown in figure can be operated in forward or reverse direction via a DC motor. The DC motor can be operated from local/remote locations. The conveyer can be totally stopped from local or remote location too.



3- The wiper blade shown in Fig.3. is operated by a DC motor operating in forward direction for 1 second and reverse direction for 1 second and loops until the stop push button is pressed and restarted when start push button is pressed.

4- Part of a washing machine operating sequence is as follows:
Lock Door→Open water valve for 40 seconds→Stir in left direction for 90 seconds→ Stir in right direction for 90 seconds→Open drain valve for 40 seconds→Unlock door

Note: Valves are represented in control circuit as coils and not represented in power circuit. The washing machine operates with a DC motor.

5- It is required to control the operation of two different 3 phase induction motors M1 and M2 using the following sequence:
- M1 only rotates in the forward direction and is connected directly to the supply (DOL)
- M2 rotates in the forward direction and is connected to the supply through Y/Δ of 10 seconds.

- As you press start, M1 is ON for 1 minute and then M2 goes ON.
- After 10 minutes of operation of M2, M1 rotates in the reverse direction.
- If the main stop push button is switched ON, all motors are OFF.