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Design and construction of low cost petri dish incubator

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Petri dish incubators are used in laboratories to keep petri dish samples at a stable and optimal temperature of 37 °C. Incubators are one of the frequently needed equipment. These incubators are expensive due to the use of complex systems. Many of the local universities do not have the necessary financial resources to purchase this equipment. Therefore, undergraduate students usually do not have access to incubators for academic learning. In order to surmount this challenge, it is necessary to look at a low cost, simple design for petri dish incubators. Hence, we have designed an incubator utilizing low cost microcontroller boards and sensors. Both microcontrollers and sensors were selected to provide adequate accuracy for the incubation at 37 °C. The incubator is constructed of three major components; sensors, controller and temperature regulation system. The incubator uses three LM35 temperature sensors to monitor the temperature with 0.5 °C accuracy and the system is controlled by Arduino Uno board with 16 MHz ATmega328P microcontroller. The microcontroller regulates the temperature of the incubation chamber utilizing 200W Nichrome heating element and two exhaust fans. Three temperature sensor readings were taken to acquire chamber temperature by averaging three values. Microcontroller uses these data to control the heating element, the fan for heating and the fan for cooling. The controller uses a PID (Proportional–Integral–Derivative) algorithm to stabilize the temperature. The sensor input wiring is highly shielded to avoid interference from the main powerline magnetic noise. The incubator body is shielded with porcelain to avoid fire hazards. The average temperature recorded by the incubator sensor and the chamber temperature as recorded with a thermometer was monitored at 2 hr intervals over a 16 hr period at 37.6 ± 0.5 °C and 37.6 ± 0.5 °C respectively indicating the accuracy of temperature regulation in the petri dish incubator over an extended period of incubation.

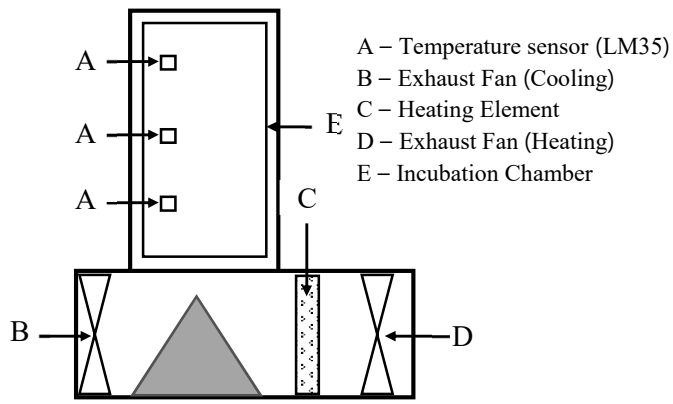

Figure: Sketch diagram of the petri dish incubator

Keywords: Petri dish incubator, Low cost incubation, Temperature controller