This project presents an innovative design of an automatic wireless temperature and humidity control system targeting energy conservation using Arduino and wireless sensors. The aim of this designed sensor-based wireless automatic temperature and humidity control system includes; effectively addressing the unsustainable use of electrical appliances by identifying instances of unnecessarily prolonged operation and demonstrating Amplitude Shift Keying serial communication to send and receive data between the two Arduino boards. The design uses a 2-channel relay module to switch on/off a DC fan or an electric bulb based on predefined temperature and humidity from a transmitting circuit and sends the value of the values to the receiving circuit. The system has a unique design, such as using the RF transmitter and receiver, DHT22 sensor, potentiometer, 2-channel relay module, and an LCD. It is suitable for institutions, disabled persons, smart homes, poultry gardens, and other mechanical workshops that deal with big machine parts that may be affected by rust. Lastly, to illustrate ASK, the transmitting circuit sends the value of the measured temperature and humidity to the receiving circuit and it checks if it is a valid message and prints out the result to an LCD.