

# Smart Ultrasonic Humidifier – Design Report

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## 1. Design Objectives

The goal is to design a smart ultrasonic humidifier system controlled via:

- **Manual push-button**
- **Bluetooth commands (HC-05)**  
It includes a **status LED** and a **MOSFET** to safely switch the atomizer circuit.

## 2. Component Selection Rationale

Component	Reason for Selection
ATmega328P	Sufficient I/Os, UART support, low power, widely supported
HC-05	Easy serial Bluetooth control
Push Button	Manual toggle feature
MOSFET (e.g., IRF540N)	Efficient switching of the atomizer.
Status LED	Visual ON/OFF feedback
USB Ultrasonic Module	Ready-to-use atomizer control circuit
Power Supply (5V Regulator)	Stable power for logic and atomizer

### 3. Pin Configuration

Function	ATmega328P Pin
HC-05 TX → RX	PD0 (RXD)
HC-05 RX ← TX	PD1 (TXD) via divider
Push Button	PD2 (INT0)
Status LED	PD4
MOSFET Gate	PD3

### 4. Control Logic

- **Button (INT0):** On falling edge, toggles humidifier state.
- **Bluetooth Commands:**
  - '1' → Turn ON
  - '0' → Turn OFF
- **LED:** Reflects current humidifier state
- **MOSFET:** Acts as switch to atomizer (controlled by PD3)

### 5. Anticipated Challenges & Solutions

Challenge	Solution
Signal interference from atomizer	Add decoupling capacitors near VCC, proper grounding
MOSFET heating	Use logic-level MOSFET with heatsink or large copper pour
Bluetooth instability	Use proper baud rate (9600), avoid noisy shared power lines
Button debounce	Implement software debounce using <code>_delay_ms(50)</code>
Reverse voltage or power surges	Add flyback diode or use protected MOSFET circuit

## Block Diagram

