

Sensors	Type/Function	Main Role	Sample Metrics/ Data Collected
KY-038	Analog Sound Sensor	Detects external noise or disturbances (e.g., predators, human interference) near the hive to trigger the defense mechanism.	Sound intensity (analog voltage level) - Sudden noise spikes (Hz / dB) - Disturbance detection (binary signal)
DS18B20	Digital Temperature Sensor	Monitors hive surface or external temperature to detect abnormal heat signatures or fire hazards that may endanger the colony.	External temperature (°C) - Rapid temperature fluctuations
Adafruit SPH0645LM4H	MEMS Digital Microphone	Captures detailed acoustic data to analyze bee sounds for colony health, swarming behavior, or distress signals.	Sound pressure level (dB SPL) - Bee acoustic patterns (Hz / waveform)
DFRobot Gravity Non-Contact Digital Liquid Sensor	Capacitive Liquid Level Sensor	Detects honey or nectar levels in storage compartments or feeders without contamination.	Liquid presence (binary output) - Level threshold (low/high)
BME280	Environmental Sensor	Measures environmental factors	Ambient temperature (°C) - Relative humidity

		influencing bee behavior and brood rearing.	(%) - Atmospheric pressure (hPa) - Altitude estimation (m)
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