

## DAFTAR GAMBAR

Gambar 2.2 Sensor MQ-135.....	14
Gambar 2.3 LCD 16x2 i2C .....	15
Gambar 2.4 NodeMCU ESP8266.....	16
Gambar 3. 1 NodeMCU dengan LCD 16x2.....	20
Gambar 3.3 NodeMCU dengan MQ135 .....	20
Gambar 3.4 Keseluruhan Rangkaian Sistem .....	21
Gambar 3.5 Flowchart Perancangan Wifi .....	22
Gambar 3. 6 Flowchart Sistem Keseluruhan .....	23
Gambar 3.7 Blok Diagram Sistem.....	23
Gambar 4. 1 Deteksi CO Kondisi Normal.....	27
Gambar 4.2 Deteksi CO2 Kondisi Normal.....	27
Gambar 4.3 Deteksi Aseton Kondisi Normal.....	28
Gambar 4.4 Deteksi CO2 dengan Korek Gas.....	28
Gambar 4.5 Deteksi CO dengan gas korek api.....	29
Gambar 4.6 Deteksi Aseton dengan Gas Korek Api.....	29
Gambar 4. 7 Deteksi CO Asap Kendaraan.....	30
Gambar 4. 8 Deteksi CO2 Asap Kendaraan.....	30
Gambar 4. 9 Deteksi Asetom Asap Kendaraan .....	31
Gambar 4. 10 Deteksi CO2 dengan Kondisi Normal .....	32
Gambar 4. 11 Deteksi CO2 Dengan Korek Gas.....	32
Gambar 4. 12 Deteksi CO2 Dengan Asap Kendaraan.....	33
Gambar 4. 13 Pengujian di depan rumah .....	34
Gambar 4. 14 Pengujian di gerbang perumahan.....	34
Gambar 4. 15 Pengujian di atas Tol SBY-MLG .....	35
Gambar 4. 16 Pengujian di area Industri Tekstil.....	35

Gambar 4. 17 Pengujian di Jl Raya Taman.....	36
Gambar 4. 18 Pengujian di Bundaran Waru .....	36
Gambar 4. 19 Pengujian di Taman Pelangi.....	37
Gambar 4. 20 Pengujian di Panjang Jiwo .....	37
Gambar 4. 21 Pengujian di Parkir Motor UNTAG .....	38
Gambar 4. 22 Aplikasi Mobile.....	41
Gambar 4. 23 Login ThingSpeak.....	41
Gambar 4. 24 Halaman Utama ThingSpeak .....	42
Gambar 4. 25 Halaman Channel .....	43
Gambar 4. 26 Hasil pada ThingSpeak .....	44

## **DAFTAR TABEL**

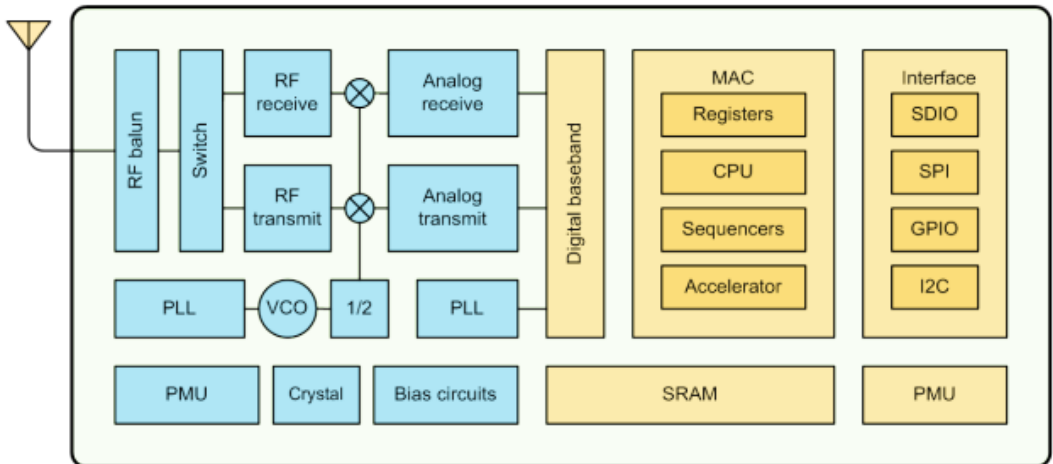
Tabel 2. 1 Kajian Pustaka.....	7
Tabel 2.2 Indeks Standar CO2.....	10
Tabel 2. 3 Indeks Standar CO.....	11
Tabel 2. 4 Indeks Standar Aseton.....	11
Tabel 2. 5 Spesifikasi Standar Kerja Sensor MQ-135.....	14
Tabel 4.1 Kriteria Perangkat Keras .....	25
Tabel 4.2 Pengujian tahap pertama.....	38
Tabel 4. 3 Pengujian tahap ke dua.....	39
Tabel 4. 4 Pengujian tahap ke tiga.....	40

## LAMPIRAN

### 1. Data Sheets Mikrokontroler NodeMCU ESP8266

#### 1.1 Introduction

Espressif Systems' Smart Connectivity Platform (ESCP) is a set of high performance, high integration wireless SOCs, designed for space and power constrained mobile platform designers. It provides unsurpassed ability to embed WiFi capabilities within other systems, or to function as a standalone application, with the lowest cost, and minimal space requirement.



ESP8266EX Block Diagram

ESP8266EX offers a complete and self-contained WiFi networking solution; it can be used to host the application or to offload WiFi networking functions from another application processor. When ESP8266EX hosts the application, it boots up directly from an external flash. It has integrated cache to improve the performance of the system in such applications. Alternately, serving as a WiFi adapter, wireless internet access can be added to any microcontroller-based design with simple connectivity (SPI/SDIO or I2C/UART interface). ESP8266EX is among the most integrated WiFi chips in the industry; it integrates the antenna switches, RF balun, power amplifier, low noise receive amplifier, filters, power management modules, it requires minimal external circuitry, and the entire solution, including front-end module, is designed to occupy minimal PCB area. ESP8266EX also integrates an enhanced version of Tensilica's L106 Diamond series 32-bit processor, with on-chip SRAM, besides the WiFi functionalities. ESP8266EX is often integrated with external sensors and other application-specific devices through its GPIOs; sample codes for such applications are provided in the software

development kit (SDK).

## 1.2 Features

- 802.11 b/g/n
- Integrated low power 32-bit MCU
- Integrated 10-bit ADC
- Integrated TCP/IP protocol stack
- Integrated TR switch, balun, LNA, power amplifier and matching network
- Integrated PLL, regulators, and power management units
- Supports antenna diversity
- WiFi 2.4 GHz, support WPA/WPA2
- Support STA/AP/STA+AP operation modes
- Support Smart Link Function for both Android and iOS devices
- SDIO 2.0, (H) SPI, UART, I2C, I2S, IR Remote Control, PWM, GPIO
- STBC, 1x1 MIMO, 2x1 MIMO
- A-MPDU & A-MSDU aggregation & 0.4s guard interval
- Deep sleep power <10uA, Power down leakage current < 5uA
- Wake up and transmit packets in < 2ms
- Standby power consumption of < 1.0mW (DTIM3)
- +20 dBm output power in 802.11b mode
- Operating temperature range -40C ~ 125C

- FCC, CE, TELEC, WiFi Alliance, and SRRC certified

### 1.3 Parameters

Categories	Items	Values
<b>WiFi Parameters</b>	Certificates	FCC/CE/TELEC/SRRC
	WiFi Protocles	802.11 b/g/n
	Frequency Range	2.4G-2.5G (2400M-2483.5M)
	Tx Power	802.11 b: +20 dBm
		802.11 g: +17 dBm
		802.11 n: +14 dBm
	Rx Sensitivity	802.11 b: -91 dbm (11 Mbps)
802.11 g: -75 dbm (54 Mbps)		
802.11 n: -72 dbm (MCS7)		
Types of Antenna	PCB Trace, External, IPEX Connector, Ceramic Chip	
<b>Hardware Parameters</b>	Peripheral Bus	UART/SDIO/SPI/I2C/I2S/IR Remote Control
		GPIO/PWM
	Operating Voltage	3.0~3.6V
	Operating Current	Average value: 80mA
	Operating Temperature Range	-40°~125°
	Ambient Temperature Range	Normal temperature
	Package Size	5x5mm
External Interface	N/A	
<b>Software Parameters</b>	WiFi mode	station/softAP/SoftAP+station
	Security	WPA/WPA2
	Encryption	WEP/TKIP/AES
	Firmware Upgrade	UART Download / OTA (via network)
	Ssoftware Development	Supports Cloud Server Development / SDK for custom firmware development
	Network Protocols	IPv4, TCP/UDP/HTTP/FTP
	User Configuration	AT Instruction Set, Cloud Server, Android/ iOS App

## 2. Data Sheets Sensor MQ-135

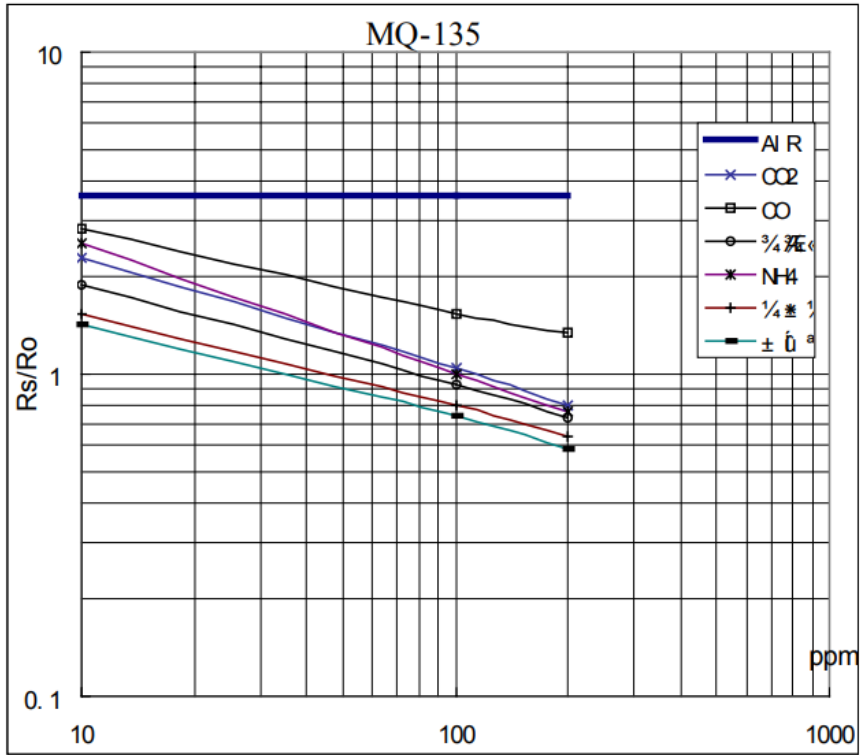
### 2.1 Introduction

Sensitive material of MQ135 gas sensor is SnO<sub>2</sub>, which with lower conductivity in clean air. When target pollution gas exists, the sensor's conductivity gets higher along with the gas concentration rising. Users can convert the change of conductivity to correspond output signal of gas concentration through a simple circuit. MQ135 gas sensor has high sensitivity to ammonia gas, sulfide, benzene series steam, also can monitor smoke and other toxic gases well. It can detect kinds of toxic gases and is a kind of low-cost sensor for kinds of applications.

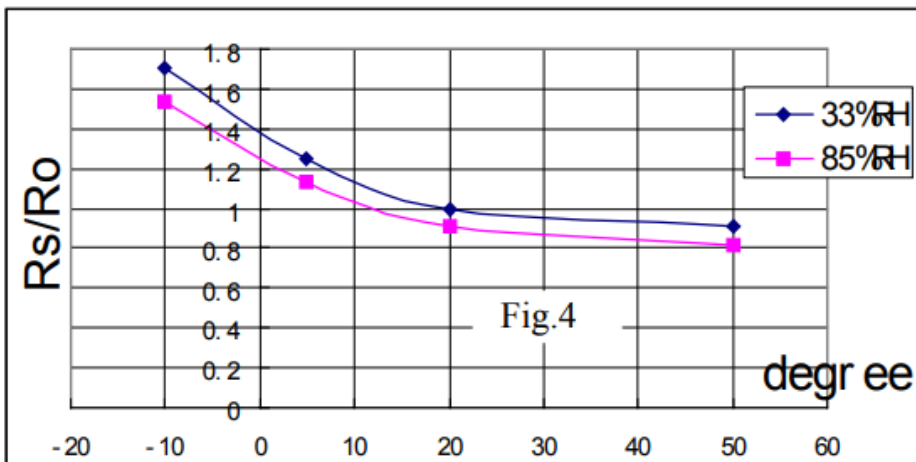
### 2.2 Parameters

Model			MQ135
Sensor Type			Semiconductor
Standard Encapsulation			Bakelite, Metal cap
Target Gas			ammonia gas, sulfide, benzene series steam
Detection range			10~1000ppm( ammonia gas, toluene, hydrogen, smoke)
Standard Circuit Conditions	Loop Voltage	$V_c$	$\leq 24V$ DC
	Heater Voltage	$V_H$	$5.0V \pm 0.1V$ AC or DC
	Load Resistance	$R_L$	Adjustable
Sensor character under standard test conditions	Heater Resistance	$R_H$	$29\Omega \pm 3\Omega$ (room tem.)
	Heater consumption	$P_H$	$\leq 950mW$
	Sensitivity	$S$	$R_s(\text{in air})/R_s(\text{in } 400\text{ppm } H_2) \geq 5$
	Output Voltage	$V_s$	$2.0V \sim 4.0V$ (in 400ppm $H_2$ )
	Concentration Slope	$\alpha$	$\leq 0.6(R_{400\text{ppm}}/R_{100\text{ppm}} H_2)$
Standard test conditions	Tem. Humidity		$20^\circ C \pm 2^\circ C$ ; $55\% \pm 5\% RH$
	Standard test circuit		$V_c: 5.0V \pm 0.1V$ ; $V_H: 5.0V \pm 0.1V$
	Preheat time		Over 48 hours

### 2.3 Sencor Characters



Typical sensitivity characteristics of the MQ-135



Typical dependence of the MQ-135 on temperature and humidity.