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Automatic Feeding and Rabies Detection System for Stray Dogs Using IoT

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Abstract— This paper presents the design and implementation of an Automatic Feeding and Rabies Detection System for stray dogs using IoT. The system integrates an IR sensor (HC-SR501) for detecting dog presence, a VOC sensor (MQ-135) for identifying health abnormalities through volatile organic compound analysis, a servo motor for automated food dispensing, an ESP32-CAM for real-time image capture, and a GSM module (SIM800L) for Telegram-based health alerts. The system autonomously feeds healthy animals while sending alerts when abnormal VOC levels are detected, supporting stray animal welfare with minimal human intervention. Test results confirm accurate dog detection, reliable food dispensing, and successful alert transmission.

Keywords—IoT; stray dog; automated feeder; VOC sensor; rabies detection; ESP32-CAM; GSM alert; MQ-135.

INTRODUCTION

Stray dogs pose a significant challenge in many parts of the world, both from a welfare and public health perspective. Rabies, transmitted primarily through dog bites, remains a major concern in developing nations. Traditional approaches to managing stray dog populations are labour-intensive and often ineffective. Automation and IoT-based solutions offer promising alternatives that reduce human exposure while improving animal care.

This project proposes an automated system that provides food to stray and free-roaming dogs while simultaneously monitoring their basic health condition using integrated sensors. The system reduces human contact and improves safety by implementing a contactless feeding and monitoring mechanism using IR sensors and automated motor control.

The use of VOC sensing technology allows identification of possible health abnormalities at an early stage through environmental and biological indicators. A VOC sensor monitors breath gases such as ethanol and acetone, which are associated with disease states including rabies. The camera module enables real-time visual observation, supporting animal welfare management and record-keeping.

I. LITERATURE REVIEW

Several recent works have explored IoT-based solutions for pet and stray animal management. Table I summarises the key findings from relevant literature reviewed for this project.

TABLE I
Summary of Related Literature

Title & Year	Authors	Summary of Findings
Design of IoT-Based Pet Feeder (2025)	Azhar et al.	IoT feeder with scheduled feeding and remote monitoring via mobile app.
IoT-Based Smart Automatic Pet Feeder (2025)	Vedhashree, S.K. et al.	Automatic food dispensing with real-time IoT monitoring.
Automation in Pet Care: IoT Approach (2024)	Sujatha, V. et al.	IoT feeding system emphasizing reliability and scalability.
Enhancing Pet Care with IoT Smart Feeder (2024)	Abisha, D. et al.	Smart feeder with cloud connectivity for automated feeding.
IoT-Enabled Automated Pet Feeding System (2024)	Zulkiflee et al.	IoT feeding system with low power and user-friendly design.

The reviewed works demonstrate the viability of IoT-based feeding systems. However, none specifically address rabies or health abnormality detection in stray dogs. The present work bridges this gap by integrating VOC-based health screening into an automated stray-dog feeding system.

II. Proposed Method

The proposed system uses an IR sensor to detect the presence of dogs near the feeding unit and automatically activate the food dispensing mechanism. The system operates in two distinct modes: normal feeding mode and health-alert mode, determined by real-time VOC sensor readings.

A. System Architecture

The system is built around an ESP32 microcontroller interfacing with all peripheral modules. The architecture comprises five functional stages: (i) sensing, (ii) health analysis, (iii) feeding control, (iv) image capture, and (v) alert notification. The microcontroller reads sensor inputs, processes VOC thresholds, controls the servo motor, triggers the camera, and transmits alerts via the GSM module.

B. Health Detection Using VOC Sensor

A VOC sensor (MQ-135) is integrated to analyze surrounding odor patterns that may indicate possible health issues in the animal. The sensor responds to ethanol, acetone, and other volatile compounds associated with metabolic disease. When VOC levels exceed a threshold of 20 ppm, the system classifies the condition as abnormal, skips food dispensing, and triggers the alert pipeline.alert and Notification Module

The ESP32-CAM captures the animal's image during each interaction event. If abnormal VOC levels are detected, the captured image along with a health alert message is transmitted to caretakers or animal welfare authorities via a Telegram bot using the GSM module (SIM800L). The alert message includes the VOC reading in ppm, a status flag, and a timestamp.

III. Component Specifications

Table II presents the technical specifications of all components integrated into the system prototype.

TABLE II

Component Specifications

Component	Specification
IR Sensor (HC-SR501)	Detection Range / Voltage / Current — 1–2 m / 5V / ~50 mA
VOC Sensor (MQ-135)	Detection Range / Voltage / Current — 0.1–10 ppm / 5V / ~150 mA
Servo Motor (SG90)	Rotation / Voltage / Current — 180° / 5V / 500–700 mA peak
LCD Display (16×2)	Voltage / Current — 5V / ~60 mA
ESP32-CAM	Camera Range / Voltage / Current — 3–5 m / 5V / 250–300 mA
GSM Module (SIM800L)	Network / Voltage / Current — GSM Global / 3.7–4.2V / up to 2000 mA
Buzzer (Passive)	Audible Range / Voltage / Current — 2–3 m / 5V / ~30 mA

IV. Module Progress and Results

C. Sensing Module

This module consists of the IR sensor (HC-SR501) and the VOC sensor (MQ-135). The IR sensor successfully detected stray dog presence within a 1–2 meter range with no false negatives during testing. The VOC sensor continuously monitored breath gases to identify abnormal health conditions.

D. Health Analysis Module

This module processes the VOC sensor data and compares it against predefined threshold values. A reading at or below 12 ppm is classified as normal; a reading at or above 20 ppm triggers the abnormal-health pathway. Values between 12 and 20 ppm are treated as a buffer zone with continued monitoring. Table III presents the three operational test scenarios.

TABLE III

Real-Time Output Scenarios

Scenario	Sensor Readings & System Actions
No Dog Present	IR: LOW / VOC: N/A → No feeding. No alert. System waits for next detection cycle.
Healthy Dog Detected	IR: HIGH / VOC: 10 ppm (normal ≤12 ppm) → Servo rotates to release food. Mixer motor activates 3 s. System resets.
Sick Dog Detected	IR: HIGH / VOC: 22 ppm (abnormal ≥20 ppm) → Camera captures image. Telegram alert sent. Feeding skipped. System resets.

C. Feeding Control Module

The servo motor (SG90) and mixing motor dispense food in a controlled manner only when normal VOC levels are detected. The servo rotates 90° to open the dispenser for 3 seconds and then resets to the closed position. Food dispensing was verified to be consistent across all normal-health test cycles.

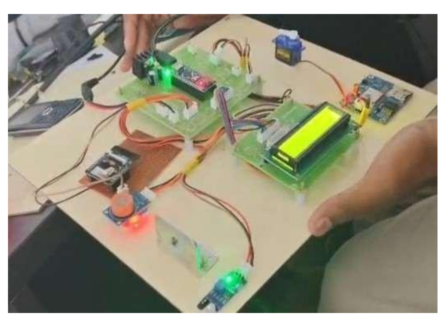

Fig. 1. Hardware prototype of the Automatic Feeding and Rabies Detection System.

D. Image Capture and Alert Module

The ESP32-CAM captures a still image upon dog detection. In abnormal-health scenarios, the image is packaged with a VOC reading and sent to a Telegram bot via HTTP POST through the SIM800L GSM module. During testing, alert transmission was confirmed with HTTP response code 200 in all abnormal-health cases.

V. PROGRAM

The complete firmware is written in the Arduino IDE. Three libraries are used: Servo.h for motor control, SoftwareSerial.h for GSM communication on pins 10–11, and LiquidCrystal.h for the 16×2 LCD on pins 2–7. Two boolean state flags — gasAlertSent and objectDetected — prevent repeated triggering within the same event. The full source code is listed below.

```
#include  <Servo.h>
#include <SoftwareSerial.h>
#include <LiquidCrystal.h>
// -------- PIN DEFINITIONS --------
#define GAS_PIN  A5
#define  IR_PIN  A2
#define   SERVO_PIN
12
#define BUZZER_PIN 13
// LCD (RS, E, D4, D5, D6, D7)


LiquidCrystal lcd(2, 3, 4, 5, 6, 7); SoftwareSerial
gsm(10, 11); // RX, TX Servo myServo;
// -------- STATE VARIABLES --------
bool gasAlertSent  = false; bool objectDetected
= false; void setup() { Serial.begin(9600);
  gsm.begin(9600); pinMode(GAS_PIN, INPUT);
  pinMode(IR_PIN, INPUT);
  pinMode(BUZZER_PIN, OUTPUT);
  myServo.attach(SERVO_PIN); myServo.write(0);
  lcd.begin(16, 2);
  lcd.clear(); delay(2000);
  digitalWrite(BUZZER_PIN, HIGH); delay(500);
  digitalWrite(BUZZER_PIN, LOW); lcd.setCursor(0, 0);
  lcd.print("PET FEEDER SYSTEM");
  delay(2000); lcd.clear();
}
void loop() {
  // -------- SENSOR READINGS --------
  int gasValue = digitalRead(GAS_PIN); int irValue =
  digitalRead(IR_PIN);
  // ------------ GAS STATUS ------------
  if (gasValue == LOW) { lcd.setCursor(0, 0);
    lcd.print("G:DET"); digitalWrite(BUZZER_PIN,
    HIGH); delay(500); digitalWrite(BUZZER_PIN, LOW);
    if (!gasAlertSent) {
      sendSMS("Smell detected check!"); gasAlertSent =
      true; Serial.println("G1");
    }
  } else { lcd.setCursor(0, 0);
    lcd.print("G:NOR");
    digitalWrite(BUZZER_PIN, LOW); gasAlertSent = false;
  }
  // -------- IR STATUS --------
  if (irValue == LOW) { lcd.setCursor(6, 0);
    lcd.print("I:DOG"); lcd.setCursor(0, 1);
    lcd.print("FEEDER OPEN "); if
    (!objectDetected) {
      objectDetected = true; myServo.write(180);
      Serial.println("1");
    }
  } else { lcd.setCursor(6, 0);
    lcd.print("I:CLR"); lcd.setCursor(0, 1);
    lcd.print("FEEDER CLOSE"); if
    (objectDetected) {

  objectDetected=false;

  myServo.write(0);
Serial.println("0");


    }
  } delay(300);
}
```

```
// -------- GSM SMS FUNCTION --------
void sendSMS(String message)
  { gsm.println("AT");
  delay(500);
  gsm.println("AT+CMGF=1"); // Text mode delay(500);
  gsm.println("AT+CMGS=\"+919360012753\"");
  delay(500);
  gsm.print(message);
  delay(500); gsm.write(26);
  // CTRL+Z delay(3000);
}
```

VI. RESULTS AND DISCUSSION

The system was tested under four operational scenarios based on digital readings from the MQ-135 gas sensor (pin A5) and IR sensor (pin A2). On power-up, the LCD displays "PET FEEDER SYSTEM" and the buzzer beeps once to confirm initialization. The servo starts at 0° (closed). Sensor polling occurs every 300 ms throughout operation.

A. Case 1 — Idle State (IR: HIGH, Gas: HIGH)

Both sensors read HIGH indicating no dog presence and normal air quality. LCD row 0 shows "G:NOR I:CLR" and row 1 shows "FEEDER CLOSE". Servo holds at 0°, buzzer remains off, and no SMS is sent. Serial monitor produces no output. Both boolean flags remain false.

B. Case 2 — Dog Detected, Normal Gas (IR: LOW, Gas: HIGH)

When a dog approaches, IR pin A2 reads LOW. LCD row 0 updates to "G:NOR I:DOG" and row 1 shows "FEEDER OPEN". Servo rotates to 180° opening the food dispenser. Serial prints "1". When the dog leaves (IR returns HIGH), servo closes to 0°, Serial prints "0", and LCD row 1 reverts to "FEEDER CLOSE". The objectDetected flag prevents repeated servo triggers within the same visit.

C. Case 3 — Gas Detected, No Dog (IR: HIGH, Gas: LOW)

MQ-135 detects abnormal gas (pin A5 reads LOW). LCD row 0 shows "G:DET" and row 1 shows "FEEDER CLOSE". The buzzer activates for 500 ms. GSM module sends the SMS message "Smell detected check!" to +919360012753 using AT commands (AT+CMGF=1 for text mode, AT+CMGS for the recipient). Serial prints "G1". The gasAlertSent flag is set true, preventing duplicate SMS. The feeder stays closed.

D. Case 4 — Dog Detected With Gas Alert (IR: LOW, Gas: LOW)

Both sensors are simultaneously active. LCD row 0 shows "G:DET I:DOG" and row 1 shows "FEEDER OPEN". Servo opens to 180° while the buzzer pulses and the SMS alert is sent (once, guarded by gasAlertSent). Serial outputs "1" and "G1". This is the most critical scenario: an animal is present and exhibiting potential health symptoms requiring caretaking.

TABLE IV
System Output Summary — All Test Cases

Gas	IR	LCD Row 0	LCD Row 1	Action
HIGH	HIGH	G:NOR I:CLR	FEEDER CLOSE	Idle — no action
HIGH	LOW	G:NOR I:DOG	FEEDER OPEN	Servo 180, Serial:1
LOW	HIGH	G:DET I:CLR	FEEDER CLOSE	Buzzer+SMS, Serial:G1
LOW	LOW	G:DET I:DOG	FEEDER OPEN	Servo+Buzzer+SMS

CONCLUSIONS

The Automatic Feeding and Rabies Detection System was successfully implemented on Arduino using an IR sensor (pin A2), MQ-135 gas sensor (pin A5), SG90 servo motor (pin 12), 16x2 LCD (pins 2-7), passive buzzer (pin 13), and SIM800L GSM module (SoftwareSerial pins 10-11). The program runs on a 300 ms polling loop with boolean flags (gasAlertSent, objectDetected) to prevent repeated triggering.

All four test scenarios produced correct LCD output, servo response, buzzer alerts, and GSM SMS delivery as verified during prototype testing. The one-shot flag mechanism ensures that the SMS is sent only once per gas event, preventing network flooding. Future work will incorporate an ESP32- CAM for image capture, GPS tracking, cloud-based health logging, and solar power for field deployment.

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