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CAFFE VISITOR COUNTER BASED ANDROID ULTRASONIC SENSOR AND BLUETOOTH

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Abstract. In the cafe industry, real-time visitor monitoring is a critical challenge for operational optimization. This study develops a visitor counting system based on ultrasonic sensors and Bluetooth communication, designed for cafes in Indonesia. The ultrasonic sensor detects the presence of visitors based on distance, while the data is sent to an Android application via the HC-05 Bluetooth module. With an experimental approach, the system was tested in different scenarios (individual visitors, groups, and walking speed) to evaluate the accuracy. The results show that the sensor is able to identify visitors at a distance of ≤15 cm. Bluetooth integration ensures stable data transmission with a maximum distance of 10 meters. This system provides a cost-effective wireless solution for cafe owners, although further research is needed to overcome the drawbacks in dynamic scenarios.

Keywords: *Ardunino, Bluetoothm Caffe, Sensors, Ultrasonic.*
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INTRODUCTION

A cafe is a culinary business that not only provides food and drinks, but also offers a comfortable atmosphere to relax, discuss, or just hang out with friends. Unlike restaurants in general, cafes emphasize a relaxed atmosphere, visitor comfort, and light entertainment such as background music. During the pandemic, community activities were limited, including the number of visitors allowed to enter public places such as cafes. This restriction has an impact on visitor visit patterns and changes the operational strategy of the cafe business. Therefore, it is important for cafe owners to monitor the number of visitors accurately as a basis for making strategic decisions.

The number of visitors is one of the main indicators in assessing the performance of a culinary business. By knowing the daily or monthly visit trends, business actors can evaluate whether their business is growing or declining. If there is a gradual decrease in the number of visitors, anticipatory steps such as promotions, discounts, or loyalty programs can be implemented immediately to reattract consumer interest.

Currently, many cafes still use manual calculation methods to record the number of visitors. This method has several disadvantages, such as being time-consuming, prone to human error, and lacking data objectivity. To overcome this, an automatic counting system can be an effective and efficient solution. Automatic counting systems have been widely applied in various fields, one of which is to detect the number of people entering and leaving a room. One technology that can be used in this system is an ultrasonic sensor. This sensor works by detecting the presence of objects based on a certain distance. When visitors are detected by the ultrasonic sensor, the data will be sent to the microcontroller. The microcontroller acts as a data processing center which then sends the calculation results to output devices such as screens or buzzers, and transmits data via Bluetooth. Data sent via Bluetooth is then displayed on an Android device so that it can be monitored in real time by the user.

Based on this background, this study aims to develop a visitor counting system in a cafe by utilizing ultrasonic sensors and Bluetooth communication integrated with an Android application. This system is expected to provide an accurate, practical, and easy to implement solution in small to medium businesses such as cafes.

METHODS

This community service project employs an experimental method to design and develop a visitor counting system for cafés, aiming to improve the accuracy, efficiency, and convenience of visitor monitoring. The system is built using several key components, including an Arduino UNO microcontroller, Arduino IDE software for programming, a breadboard for circuit assembly, jumper wires for electrical connections, an HC-05 Bluetooth module for wireless communication, an ultrasonic sensor (HC-SR04) for detecting incoming visitors, a buzzer as an auditory feedback indicator, and the Arduino Bluetooth Controller application for data visualization on Android devices.

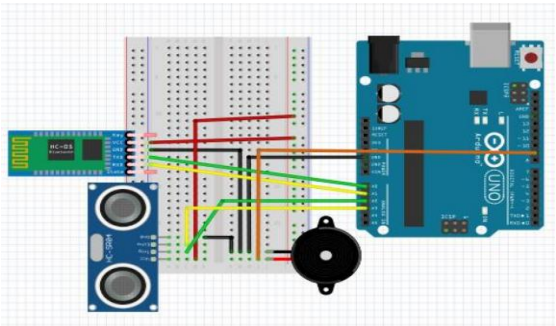

Figure. 1 Design of the visitor counting device for cafés

The overall system architecture and operational design are illustrated in **Figure 1**. At the core of the system is the Arduino microcontroller, which serves as the central processing unit responsible for managing input from the sensor and coordinating output actions. The ultrasonic sensor is positioned at the entrance of the café to detect individuals

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entering the premises by measuring the distance between the sensor and the object. When a person passes within the detection range, the sensor sends a signal to the Arduino, which processes the data and triggers the buzzer to provide immediate confirmation that a visitor has been counted. Simultaneously, the data is transmitted via the Bluetooth module to a smartphone or tablet, allowing real-time monitoring through the Android application.

RESULT AND DISCUSSION

The outcome of this community service project is a functional visitor counting device programmed using the Arduino IDE, designed to detect individuals entering a café and transmit real-time data via Bluetooth to a smartphone for monitoring purposes. The system utilizes an ultrasonic sensor as the primary detection component. As illustrated in **Figure 1**, the program begins with the initialization phase, where pin assignments for the ultrasonic sensor are declared. This is followed by the configuration of the Bluetooth module using Software Serial communication, with TX and RX connections assigned to pins 14 and 15 respectively, as shown in **Figure 2**.

```
#include <SoftwareSerial.h>
SoftwareSerial bSerial(14, 15);
#include <NewPing.h>
#define TRIGGER_PIN 16
#define ECHO_PIN 17
#define MAX_DISTANCE 1000
#define buzPin 9

int counter = 0;
int currentState = 0;
int previousState = 0;

NewPing sonar (TRIGGER_PIN, ECHO_PIN, MAX_DISTANCE);

void setup() {
  // put your setup code here, to run once:
  Serial.begin(9600);
  Serial.println("Koneksi Berhasil");
  bSerial.begin(9600);
  bSerial.println("Koneksi Berhasil");
  delay(3000);
  pinMode(buzPin, OUTPUT);
}
```

(a)

```
void loop() {
  // put your main code here, to run repeatedly:
  unsigned int jarak = sonar.ping_cm();

  if (jarak <= 15) { // check if the input is HIGH
    digitalWrite(buzPin, HIGH);
    bSerial.print(jarak);
    bSerial.println(" cm");
    bSerial.println("Ada orang lewat..");
    currentState = 1;
    delay(500);
  }

if (currentState != previousState) {
  if (currentState == 1) {
    counter = counter + 1;
    bSerial.println("Jumlah Orang yang lewat sini");
    bSerial.println(counter);
    Serial.println("Jumlah Orang yang lewat sini");
    Serial.println(counter);
    delay(1000);
  }
}
}
```

(b)

Figure. 2 (a) Initialization Program (b) Ultrasonic Sensor Setup Program

The ultrasonic sensor is calibrated to detect objects within a distance of less than 15 cm. When a person enters the sensor's range and reduces the measured distance below this threshold, the system interprets this as a visitor entering the café. Conversely, if the measured distance remains above 15 cm, it indicates that no object or person is present within the detection zone. The system also includes a counter function that keeps track of the total number of visitors recorded on a given day.

Figure. 3 Bluetooth Output on Android

(free spacing: single 11 pt)

In addition to data transmission via Bluetooth, the system incorporates a buzzer that activates each time a visitor is detected, providing immediate auditory feedback. Once the microcontroller processes the sensor data and confirms the presence of a visitor, the information is sent wirelessly to an Android device using the Arduino Bluetooth Controller application. **Figure 3** displays the output interface on the smartphone, which shows the real-time count of visitors, allowing café owners to monitor foot traffic conveniently and efficiently.

The results presented in **Table 1** show the performance of the visitor counting system across ten different trials with varying distances. It can be observed that the system consistently detected the presence of a person when the distance between the ultrasonic sensor and the object was less than or equal to 15 cm, displaying the message "*there is someone passing by*". In contrast, when the distance exceeded 15 cm, the system responded with "*there is no one passing by*", indicating no detection. These findings confirm that the threshold value of 15 cm is effective for accurate detection in this setup.

Table 1. Results of Device Testing in the Café

Testing	Distance (cm)	Result
1	9	there is someone passing by
2	12	there is someone passing by
3	14	there is someone passing by
4	15	there is someone passing by
5	20	there is no one passing by
6	22	there is no one passing by
7	27	there is no one passing by
8	28	there is no one passing by
9	27	there is no one passing by
10	29	there is no one passing by

The buzzer successfully provided auditory feedback each time a visitor was detected, while the Bluetooth module transmitted the data reliably to the Android device for realtime monitoring. Despite its accuracy under controlled conditions, the system may face limitations in dynamic environments, such as crowded situations or noisy surroundings, which could affect sensor performance. Overall, **Table 1** demonstrates that the system is capable of functioning as intended and offers a practical solution for automated visitor counting in small scale businesses like cafés.

CONCLUSION

This study successfully designed and implemented an automated visitor counting system for cafés using an ultrasonic sensor and Bluetooth communication. The system is capable of detecting individuals entering the café by measuring the distance between the sensor and the object. With a detection threshold set at ≤ 15 cm, the ultrasonic sensor accurately identifies when someone passes by, triggering a buzzer as feedback and sending real-time data to an Android device via Bluetooth. Testing results indicate that the system performs reliably under controlled conditions, with consistent responses in detecting presence or absence of visitors. Although the system has limitations such as potential inaccuracies in crowded environments or noisy settings, it provides a practical, low cost, and efficient solution for small businesses aiming to monitor visitor numbers. Future improvements may include enhancing the algorithm for multiple person detection and integrating data logging features for long term analysis.

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