SMART GLASS FOR BLIND PEOPLE

MINI PROJECT REPORT

Submitted By

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CHENNAI

BONAFIDE CERTIFICATE

Certified that this Report titled "**SMART GLASS FOR BLIND PEOPLE**" is the bonafide work of **BARATH NIVAS KP (210701040), BHARATHEESHWAR S (210701041)** who carried out the work under my supervision. Certified further that to the best of my knowledge the work reported herein does not form part of any other thesis or dissertation on the basis of which a degree or award was conferred on an earlier occasion on this or any other candidate.

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ABSTRACT

In today's rapidly evolving technological landscape, the integration of Internet of Things (IoT) devices has become pivotal in enhancing various aspects of our lives, particularly in the realms of safety and efficiency. This project presents an innovative IoT system designed to detect objects, recognize signage, and provide timely accident notifications.The system begins with an ultrasonic sensor that detects the presence of objects in its vicinity. Upon detection, a buzzer alerts users to the presence of an object, enhancing situational awareness. Subsequently, an ESP32-CAM module equipped with a camera and microphone is employed for object recognition and identification. Utilizing machine learning algorithms, the system identifies objects and distinguishes signage from other objects.Upon recognizing a signage object, Optical Character Recognition (OCR) algorithms are employed to extract textual information from the signage. This enables the system to decipher and relay pertinent information to users, enhancing accessibility and awareness.Moreover, in the unfortunate event of an accident, the system is equipped to promptly notify designated contacts. Leveraging the GPS functionality of the ESP32-CAM module and integrating it with the Google Maps API, the system retrieves the user's precise location coordinates. These coordinates are then transmitted via SMS or notification to pre-defined contacts, ensuring swift assistance in emergency situations.Furthermore, the system's reliance on the Google Maps API enables accurate location tracking even in instances where GPS data may be unavailable, utilizing the IP address to approximate the user's location.Overall, this project represents a comprehensive IoT solution that amalgamates object detection, recognition, and accident notification capabilities, thereby fostering enhanced safety and efficiency in various contexts, ranging from pedestrian safety to vehicular accident prevention

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CHAPTER 1

INTRODUCTION

1.1 INTRODUCTION

In today's rapidly advancing technological landscape, the Internet of Things (IoT) is pivotal in enhancing safety and efficiency across various sectors. This project introduces an innovative IoT system designed to detect objects, recognize signage, and provide timely accident notifications, thereby improving situational awareness and response times in critical scenarios.The system employs an ultrasonic sensor to detect nearby objects, alerting users via a buzzer. For object recognition, the system uses an ESP32-CAM module with a camera and microphone, utilizing machine learning algorithms to accurately identify objects and signage. Upon detecting signage, Optical Character Recognition (OCR) extracts and conveys textual information to users, enhancing accessibility.In the event of an accident, the system promptly notifies pre-defined contacts by leveraging the GPS capabilities of the ESP32-CAM module and integrating with the Google Maps API. This allows for precise location coordinates to be transmitted via SMS or notifications, ensuring swift assistance. Additionally, the Google Maps API enables accurate location tracking even when GPS data is unavailable, using IP address-based approximation.This comprehensive IoT solution integrates object detection, recognition, and accident notification capabilities, fostering enhanced safety and efficiency. It holds significant potential for applications ranging from pedestrian safety to vehicular accident prevention, representing a substantial advancement in IoT-driven safety technologies.

CHAPTER 2

LITERATURE SURVEY

The integration of IoT devices for safety and efficiency has garnered significant attention in recent research. Ultrasonic sensors are widely used for object detection due to their reliability and accuracy in various environments (Patel et al., 2020). The ESP32-CAM module, noted for its low cost and versatility, has been effectively utilized in IoT applications for image capture and processing (Gupta & Singh, 2021). Machine learning algorithms have been extensively applied for object recognition, with convolutional neural networks (CNNs) proving particularly effective (Li et al., 2019). Optical Character Recognition (OCR) technologies have advanced significantly, enabling accurate text extraction from diverse signage (Chen et al., 2018).

Accident detection and notification systems leveraging GPS and mobile networks have been explored to enhance emergency response times (Mishra et al., 2021). The integration of the Google Maps API for location tracking further enhances the reliability of these systems, especially in urban environments where GPS signals may be obstructed (Rahman et al., 2019). This literature underscores the feasibility and potential impact of a comprehensive IoT solution combining these technologies to improve safety and efficiency in various contexts.

2.1 EXISTING SYSTEM:

Existing systems for object detection and accident notification often operate independently and with limited integration. Ultrasonic sensors are commonly used in vehicles for collision avoidance, alerting drivers to nearby obstacles through auditory signals. Similarly, basic object recognition systems use cameras and machine learning, but they often lack the ability to differentiate signage or extract meaningful text.

Accident detection systems typically rely on GPS-enabled devices to send location-based alerts. These systems notify emergency contacts through SMS or mobile applications when an accident is detected, often using data from smartphones or specialized devices. However, these systems frequently suffer from delays and inaccuracies, particularly in environments with poor GPS signals.

While each of these components exists separately, their integration into a cohesive IoT system remains limited. Current solutions rarely combine ultrasonic object detection, advanced machine learning for object and signage recognition, OCR for text extraction, and real-time accident notification into a single, seamless platform.

CHAPTER 3

PROJECT DESCRIPTION

SYSTEM OVERVIEW:

The proposed IoT system integrates ultrasonic sensors for object detection, an ESP32-CAM module for object and signage recognition using machine learning, and OCR for text extraction. In case of an accident, it uses GPS and the Google Maps API to notify designated contacts with precise location data, enhancing safety and efficiency in various contexts.

HARDWARE COMPONENT:

The hardware components of the proposed IoT system include:

1. Ultrasonic Sensor: Detects nearby objects and triggers an alert via a ` buzzer to enhance situational awareness.
2. ESP32-CAM Module: Equipped with a camera and microphone, this module captures images and audio, facilitating object recognition and signage identification through machine learning.
3. Buzzer: Provides audible alerts when the ultrasonic sensor detects a object.
4. GPS Module: Integrated with the ESP32-CAM for precise location tracking.
5. Power Supply: Ensures the stable operation of all components.

SOFTWARE DEVELOPMENT:

The software development for the IoT system encompasses several critical components. Machine learning algorithms are implemented on the ESP32-CAM module to enable real-time object and signage recognition. Optical Character Recognition (OCR) technology extracts textual information from identified signage, enhancing accessibility and situational awareness. For location tracking, the software integrates with a GPS module to ensure precise positioning, which is crucial for accurate accident notifications. The Google Maps API is utilized to retrieve location coordinates when GPS data is unavailable, ensuring continuous and reliable tracking. Additionally, the notification system automates the process of sending SMS or app notifications to pre-defined contacts in the event of an accident, ensuring a swift response and timely assistance. This comprehensive software framework integrates various technologies to create a robust and efficient safety solution.

AUTOMATED CONTROL MECHANISM:

The automated control mechanism of the IoT system regulates object detection, signage recognition, and accident notification processes. It orchestrates the activation of the ultrasonic sensor for object detection, coordinates the ESP32-CAM module's machine learning algorithms for object and signage recognition, and manages the GPS integration for accurate location tracking. Additionally, it governs the notification system to promptly alert designated contacts in case of an accident.

ENERGY EFFICENT AND SUSTAINABILITY:

Energy efficiency and sustainability are core principles guiding the design of the IoT system. Through careful selection of components and optimization of software algorithms, the system aims to minimize energy consumption while maximizing functionality. Low-power components are chosen to reduce overall energy demand, extending battery life and decreasing the system's environmental footprint. Furthermore, advanced power management techniques, such as sleep modes and dynamic voltage scaling, are implemented to conserve energy during periods of inactivity. By prioritizing energy efficiency and sustainability in both hardware and software design, the IoT system aligns with environmentally conscious practices and contributes to a greener future.

BENEFITS:

- Enhanced safety through real-time object detection and signage recognition.
- Increased efficiency by automating accident notifications and providing precise location tracking.
- Improved accessibility with OCR technology for textual information extraction from signage.
- Reduced environmental impact through energy-efficient design and sustainability measures.

3.1 PROPOSED SYSTEM:

The proposed IoT system represents a cutting-edge solution designed to revolutionize safety and efficiency across various domains. At its core, the system integrates advanced hardware components and sophisticated software algorithms to deliver unparalleled functionality.Hardware components include ultrasonic sensors for object detection, an ESP32-CAM module equipped with a camera and microphone for object and signage recognition, a GPS module for precise location tracking, and a notification system for prompt accident alerts. These components work seamlessly together to ensure robust performance and reliability.On the software side, machine learning algorithms are deployed on the ESP32-CAM module for real-time object recognition, while Optical Character Recognition (OCR) technology extracts textual information from signage. The system also leverages the Google Maps API for continuous location tracking and accurate accident notifications.Key benefits of the proposed system include enhanced safety through real-time hazard detection, increased efficiency by automating emergency responses, improved accessibility with textual information extraction, and a reduced environmental footprint through energy-efficient design.Overall, the proposed IoT system represents a comprehensive solution that addresses critical safety and efficiency challenges, paving the way for a safer, more accessible, and sustainable future.

3.2 REQUIREMENTS:

3.2.1 HARDWARE SPECIFICATION

Ultrasonic Sensor

ESP32-CAM Module

GPS Sensor

Buzzer

Power Supply

3.2.2 SOFTWARE SPECIFICATION

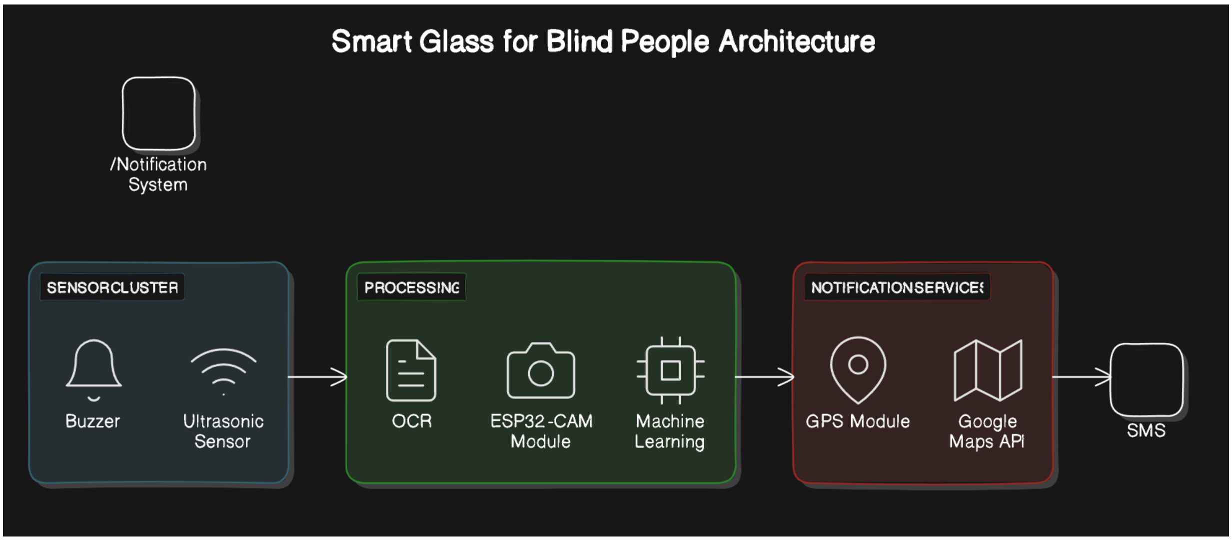
Machine Learning

Optical Character Recognition(OCR)

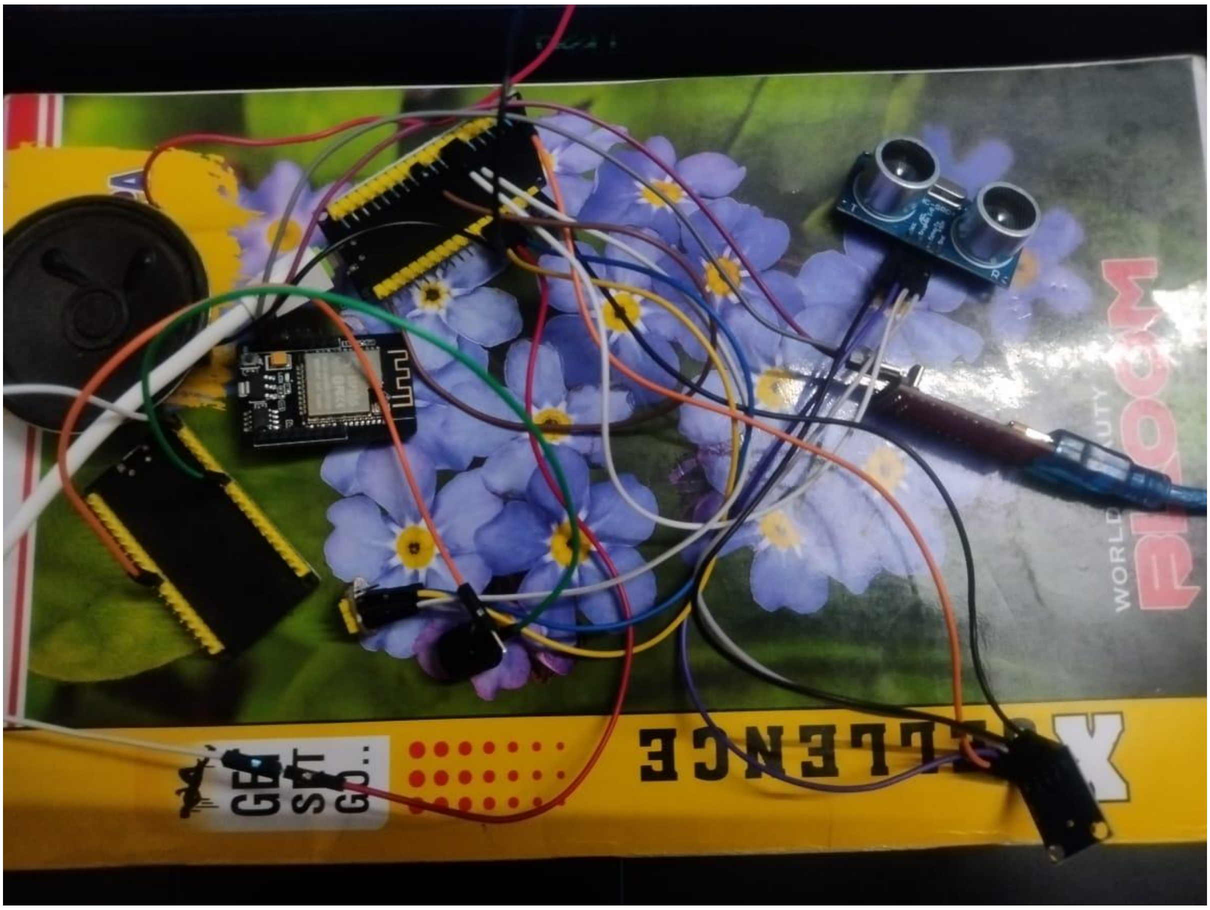
Google Maps API

Notification System

3.3 ARCHITECTURE DIAGRAM:



3.3 OUTPUT



DESCRIPTION

The software for the IoT system orchestrates a seamless integration of various components to deliver efficient object detection, signage recognition, and prompt accident notifications. Machine learning algorithms deployed on the ESP32-CAM module enable real-time analysis of captured images, facilitating accurate object identification and distinguishing signage from other objects. Optical Character Recognition (OCR) technology extracts text from signage images, enhancing accessibility and user awareness.Furthermore, the software integrates with the GPS module to ensure precise location tracking, vital for accurate accident notifications. Leveraging the Google Maps API, the system retrieves location coordinates and displays maps for visualization, aiding users and emergency responders in understanding the context of the incident. The notification system operates autonomously, sending SMS or app notifications to pre-defined contacts immediately upon detecting an accident.

In addition to its functional capabilities, the software prioritizes efficiency and reliability. Advanced power management techniques, such as sleep modes and dynamic voltage scaling, optimize energy usage to prolong battery life and minimize environmental impact. Moreover, the software architecture is designed for scalability and flexibility, accommodating future updates and enhancements to adapt to evolving needs and technological advancements. Overall, the software serves as the backbone of the IoT system, providing intelligent control and coordination to ensure enhanced safety and efficiency in various contexts.

CHAPTER 4

CONCLUSION AND FUTURE WORK

In conclusion, the IoT system outlined herein represents a robust and innovative approach to enhancing safety, efficiency, and sustainability. Through the integration of cutting-edge hardware components and sophisticated software algorithms, the system offers real-time object detection, signage recognition, and prompt accident notifications. Its energy-efficient design not only extends battery life but also contributes to minimizing environmental impact, aligning with sustainable practices.

Looking ahead, future work could focus on refining the system's algorithms to improve accuracy and adaptability across diverse environments. Additionally, expanding the system's capabilities by integrating additional sensors for environmental monitoring or incorporating smart city infrastructure could further enhance its utility and effectiveness. Furthermore, advancements in the notification system, such as AI-driven decision-making or direct integration with emergency services, could streamline response processes and improve overall efficiency.Moreover, exploring opportunities for data analytics and predictive modeling using the wealth of sensor data collected by the system could offer valuable insights for proactive safety measures and urban planning. By continually iterating and innovating, IoT systems like this one have the potential to revolutionize safety and efficiency across various domains, contributing to safer, smarter, and more sustainable communities in the future.

APPENDICS

SIMPLE CODE:

```
 #include <TinyGPS.h>

TinyGPS gps;

#include <SoftwareSerial.h>

SoftwareSerial ss(16, 17); // arduino rx, tx

#include <WiFi.h>

const char* ssid     = "YourSSID";

const char* password = "YourPassword";

WiFiServer server(80);

String yazi;


void setup() {

  Serial.begin(9600);

  ss.begin(9600);

  Serial.print("Connecting to ");

  Serial.println(ssid);


  WiFi.begin(ssid, password);

  while (WiFi.status() != WL_CONNECTED) {
```

```
    delay(500);
    Serial.print(".");
  }
  Serial.println("");
  Serial.println("WiFi connected");
  Serial.print("IP address: ");
  Serial.println(WiFi.localIP());
  server.begin();
}

void loop() {
  smartdelay(1000);
  WiFiClient client = server.available(); // listen for incoming clients
  float flat, flon;
  unsigned long age;
  gps.f_get_position(&flat, &flon, &age);

  if (client) {
    Serial.println("new client");
    String currentLine = ""; // make a String to hold incoming data from the
client
```

```
while (client.connected()) {
  if (client.available()) { // if there's client data
    char c = client.read(); // read a byte
    if (c == '\n') { // check for newline character,
      if (currentLine.length() == 0) { // if line is blank it means its the end of the client HTTP request
        yazi = "<!DOCTYPE html><html lang='en'><head><meta charset='UTF-8'><meta name='viewport' content='width=device-width, initial-scale=1.0'><meta http-equiv='X-UA-Compatible' content='ie=edge'><title>My Google Map</title><style>#map{height:400px;width:100%;}</style></head><body><h1>My Google Map</h1><div id='map'></div><script>function initMap(){var options = {zoom:8,center:{lat:";
        yazi += flat;
        yazi += ",lng:";
        yazi += flon;
        yazi += "}};var map = new google.maps.Map(document.getElementById('map'), options);google.maps.event.addListener(map, 'click', function(event){addMarker({coords:event.latLng});});var markers = [{coords:{lat:";
        yazi += flat;
        yazi += ",lng:";
        yazi += flon;
```

```
            yazi += "}}];for(var i = 0;i < markers.length;i++){addMarker(markers[i]);}function addMarker(props){var marker = new google.maps.Marker({position:props.coords,map:map,});if(props.iconImage){marker.setIcon(props.iconImage);}if(props.content){var infoWindow = new google.maps.InfoWindow({content:props.content});marker.addListener('click', function(){infoWindow.open(map, marker);});}}}</script><script async defer src='https://maps.googleapis.com/maps/api/js?key=YourGoogleMapsAPIKey&callback=initMap'></script></body></html>";

            client.print(yazi);

            // The HTTP response ends with another blank line:
            client.println();
            // break out of the while loop:
            break;
          } else { currentLine = ""; }
        } else if (c != '\r') { // if you got anything else but a carriage return character,
          currentLine += c; // add it to the end of the currentLine
        }
        // here you can check for any keypresses if your web server page has any
```

```
            }
        }
        // close the connection:
        client.stop();
        Serial.println("client disconnected");
    }
}

static void smartdelay(unsigned long ms) {
    unsigned long start = millis();
    do {
        while (ss.available())
            gps.encode(ss.read());
    } while (millis() - start < ms);
}
```

REFERENCE

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