BIKE SECURITY & CONTROL SYSTEM

A PROJECT REPORT

Submitted by

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DEPARTMENT OF COMPUTER APPLICATION

CERTIFICATE

This is to certify that this project entitled "BIKE SECURITY AND CONTROL SYSTEM" submitted in partial fulfilment of the degree of **BACHELOR OF COMPUTER APPLICATIONS** to Department of Computer Application, Government E. Raghavendra Rao PG Science College, Bilaspur(C.G), done by SAMEER KAUSHIK, is an authentic work carried out by him. The matter embodied in this project work has not been submitted earlier for award of any degree or diploma to the best of my knowledge and belief.

SANJEEV PANDEY SIR

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DECLARATION

I, SAMEER KAUSHIK, hereby declare that the work presented in this final year project titled "BIKE SECURITY & CONTROL SYSTEM" is entirely my own effort, except where otherwise indicated or acknowledged. This project report has not been submitted for any other degree or examination at any other university or institute.

I understand the academic principles and ethical considerations involved in the completion of this project and affirm that all sources of information and material used have been duly acknowledged and referenced. Any assistance received in the preparation of this report from external sources has been cited appropriately.

I take full responsibility for the authenticity and originality of this work and affirm that it does not infringe upon the intellectual property rights of any third party. Furthermore, any contributions made by others to this project have been duly acknowledged in this report.

I understand that any act of plagiarism or academic misconduct related to this project may result in disciplinary action in accordance with the policies of **GOVERNMENT E. RAGHAVENDRA RAO POSTGRADUATE SCIENCE COLLEGE, BILASPUR (C.G.) .**

Date: [_____]

Signature: _____

[SAMEER KAUSHIK]

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Lastly, I acknowledge the contributions of all authors and researchers whose work and publications have been referenced and cited in this report.

Their collective efforts have significantly enriched this project and helped in achieving its objectives.

[SAMEER KAUSHIK]

ABSTRACT

This project introduces a novel device designed for enhancing bike security and functionality through integrated electronic components. The device incorporates a GPS module for real-time location tracking, ensuring the bike's whereabouts can be monitored remotely. Additionally, a gyro sensor detects sudden movements such as a fall, triggering alerts to the user via a mobile application. The SIM800 module enables communication capabilities, allowing the device to send notifications ove bike safety and user interaction through innovative integration of electronic technologies.

Furthermore, the device is designed to be compact and seamlessly integrated into the bike's existing framework, ensuring minimal interference with its aesthetic and functional aspects. The mobile application provides a user-friendly interface for accessing real-time data, managing security settings, and controlling essential bike functions remotely. This integration of advanced electronic components not only enhances the bike's security against theft and accidents but also promotes a more connected and responsive riding experience. The project represents a significant step towards leveraging modern technology to enhance the safety, convenience, and usability of bike transportation systems.

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INTRODUCTION

The integration of advanced electronic systems into everyday vehicles, such as bicycles, has seen a significant rise in recent years. These innovations aim to enhance the safety, security, and functionality of bikes, catering to the needs of modern urban mobility. This project focuses on the development and implementation of a comprehensive electronic device specifically designed for bikes.

The device incorporates several key components to augment the bike's capabilities. A GPS module provides real-time location tracking, offering users peace of mind by enabling them to monitor their bike's whereabouts remotely. A gyro sensor detects sudden movements, such as falls or impacts, and triggers alerts to the user via a mobile application, ensuring prompt awareness of potential incidents.

Moreover, the inclusion of a SIM800 module enables bidirectional communication between the bike and the user's mobile device. This feature allows for notifications to be sent regarding critical events, such as unauthorized movement or attempted theft, while also empowering users to remotely control the bike's ignition and horn through the mobile application.

By seamlessly integrating these technologies, this project aims to redefine bike security and user interaction, paving the way for safer, smarter, and more connected biking experiences. The following sections will delve deeper into the design, implementation, and outcomes of this innovative electronic device for bikes.

METHOLOGY

Methodology

The development and implementation of the electronic device for bikes involved a structured approach encompassing several key phases:

1. **Requirements Analysis:**

- The project began with a thorough analysis of the functional requirements based on user needs and industry standards. This phase identified key features such as GPS tracking, gyroscopic motion detection, remote communication via SIM module, and mobile application integration.

2. **Design Phase:**

- During the design phase, detailed schematics and technical specifications were formulated. The device's hardware components, including the GPS module for location tracking, gyro sensor for motion detection, and SIM800 module for cellular communication, were selected based on performance, compatibility, and power efficiency.

3. **Prototyping and Development:**

- Prototyping involved assembling the selected components on a breadboard to test their functionality and integration. This phase also included developing the necessary firmware to manage sensor data, establish communication protocols, and interface with the mobile application.

4. **Integration and Testing:**

- The integrated prototype underwent rigorous testing to validate its performance under various conditions. Testing included assessing GPS accuracy, evaluating gyro sensor responsiveness to sudden movements, verifying SIM module connectivity and message transmission reliability, and ensuring seamless interaction with the mobile application.

5. **Mobile Application Development:**

- Concurrently, a mobile application was developed to interface with the electronic device. The application allowed users to view real-time bike location, receive alerts for critical events detected by the device (such as falls or unauthorized movements), and remotely control bike functions like ignition and horn activation.

6. **Evaluation and Optimization:**

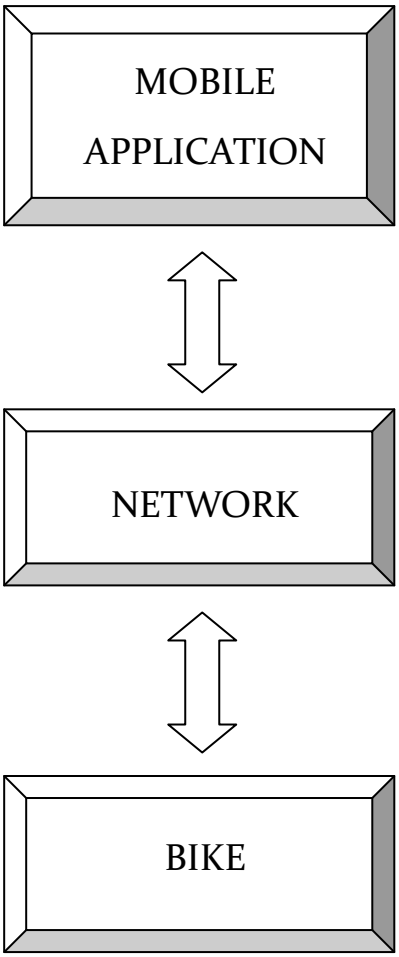
- After initial testing, the device and mobile application underwent evaluation to identify areas for improvement. Optimization efforts focused on enhancing sensor accuracy, optimizing power consumption, improving communication reliability, and refining the user interface for intuitive interaction.

7. **Documentation and Finalization:**

- The project was documented comprehensively, detailing the design rationale, implementation steps, testing procedures, and results. Final adjustments were made based on feedback from test scenarios and usability evaluations, ensuring the device met functional requirements effectively.

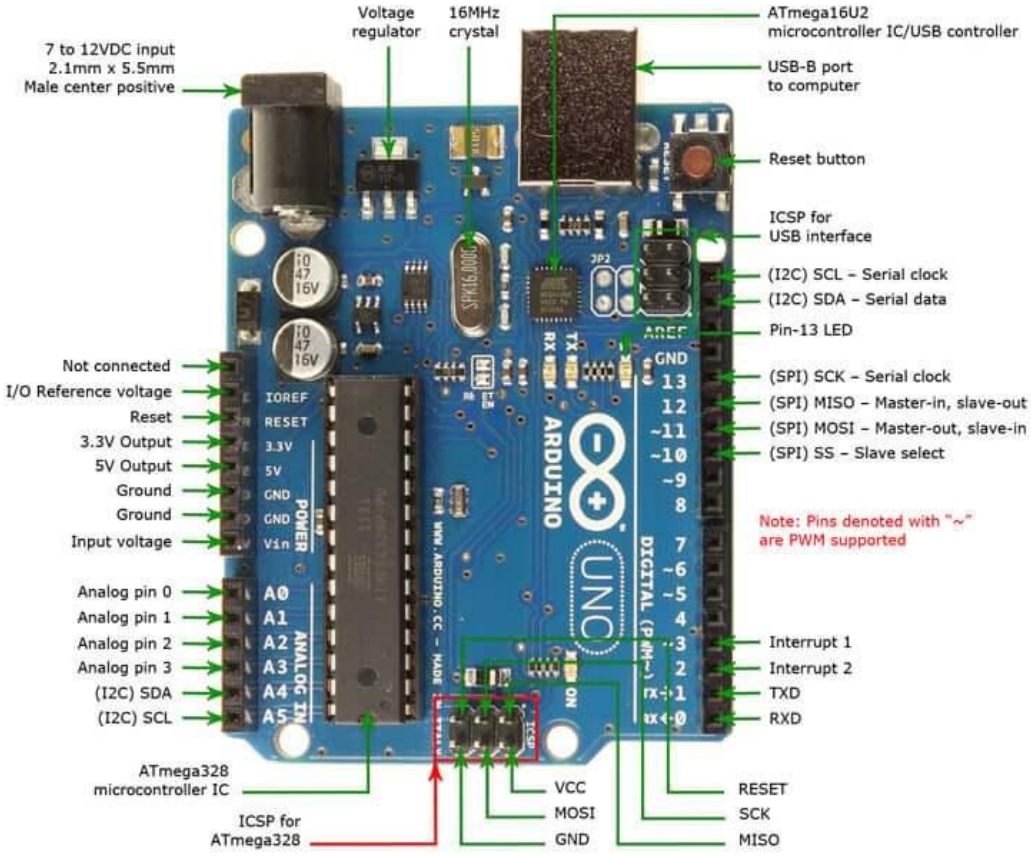
By following this methodology, the electronic device for bikes was successfully developed, integrating advanced technologies to enhance security, functionality, and user interaction in bike transportation systems. The subsequent sections of this report elaborate on the specific components, implementation details, results, and conclusions derived from this project.

FLOWCHART



HARDWARE AND COMPONENTS

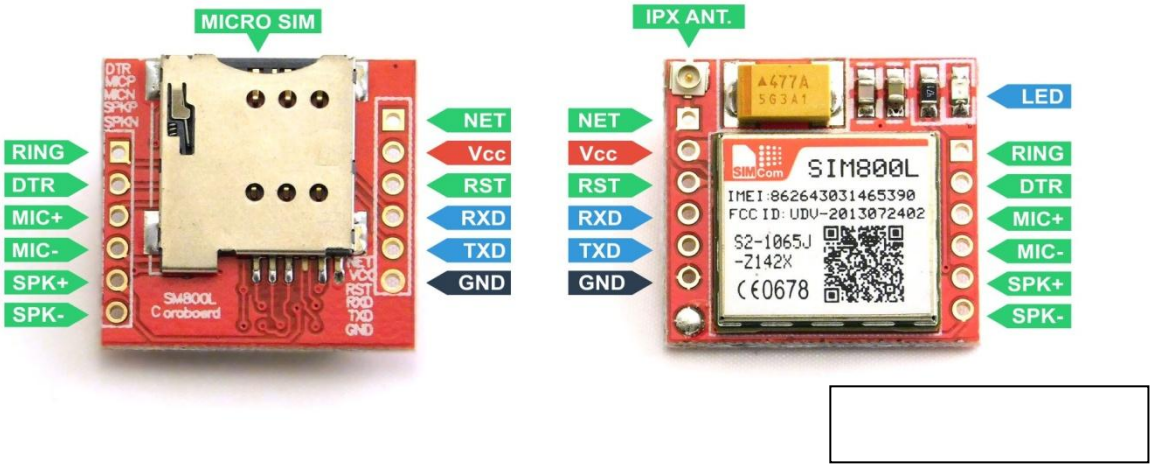
1. ARDUINO UNO R3 –



For this project, the Arduino Uno R3 serves as the central microcontroller platform, pivotal in orchestrating the integration of various electronic components. Equipped with an ATmega328P microcontroller, the Arduino Uno R3 interfaces seamlessly with essential sensors like the GPS module and gyro sensor through serial communication protocols. It manages bidirectional communication with the SIM800 module via UART, enabling real-time SMS notifications and remote control functionalities. Programmed using the Arduino IDE, the Arduino Uno R3 executes custom firmware to process sensor data, detect critical events such as bike falls detected by the gyro sensor, and control outputs like the bike's ignition and horn. Its robust architecture and widespread community support facilitate rapid prototyping, iterative development, and scalability, ensuring the

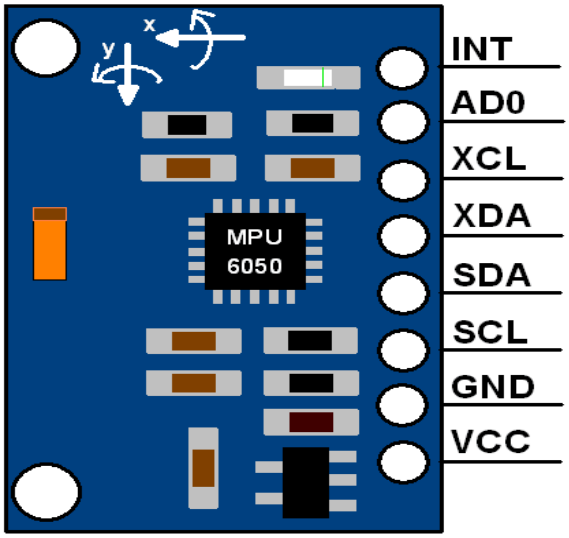
device meets stringent performance and reliability standards for enhancing bike security and user interaction.

2. SIM800L MODULE=



The SIM800 module plays a crucial role in enabling real-time communication capabilities within the bike electronic device. Operating on GSM/GPRS networks, the SIM800 module facilitates seamless transmission of data and commands between the bike and the user's mobile application. Utilizing UART communication protocol, the Arduino Uno R3 microcontroller interfaces with the SIM800 module to send SMS notifications regarding critical events such as bike falls detected by the gyro sensor or unauthorized movements. Moreover, the module supports bidirectional communication, allowing users to remotely control essential bike functions like ignition activation and horn operation through the mobile application. Its robust performance and reliable connectivity ensure effective remote monitoring and management, enhancing both the security and usability of the bike electronic device.

3. GYRO SENSOR MODULE =



1. **Functionality:** The gyro sensor (also known as a gyroscope) detects angular velocity and rotational motion along the three axes (X, Y, Z). It provides real-time data on the bike's orientation and movement dynamics.

2. **Integration:** Connected to the Arduino Uno R3 via digital or analog input pins, the gyro sensor communicates through standard communication protocols such as I2C or SPI. This integration allows the microcontroller to continuously monitor and interpret the bike's tilt, rotation, and acceleration.

3. **Detection of Falls and Impacts:** The gyro sensor is programmed to detect sudden changes in orientation or rapid movements indicative of a fall or impact. When such events occur, the sensor triggers alerts to the Arduino Uno R3, prompting immediate action or notification to the user via the SIM800 module and mobile application.

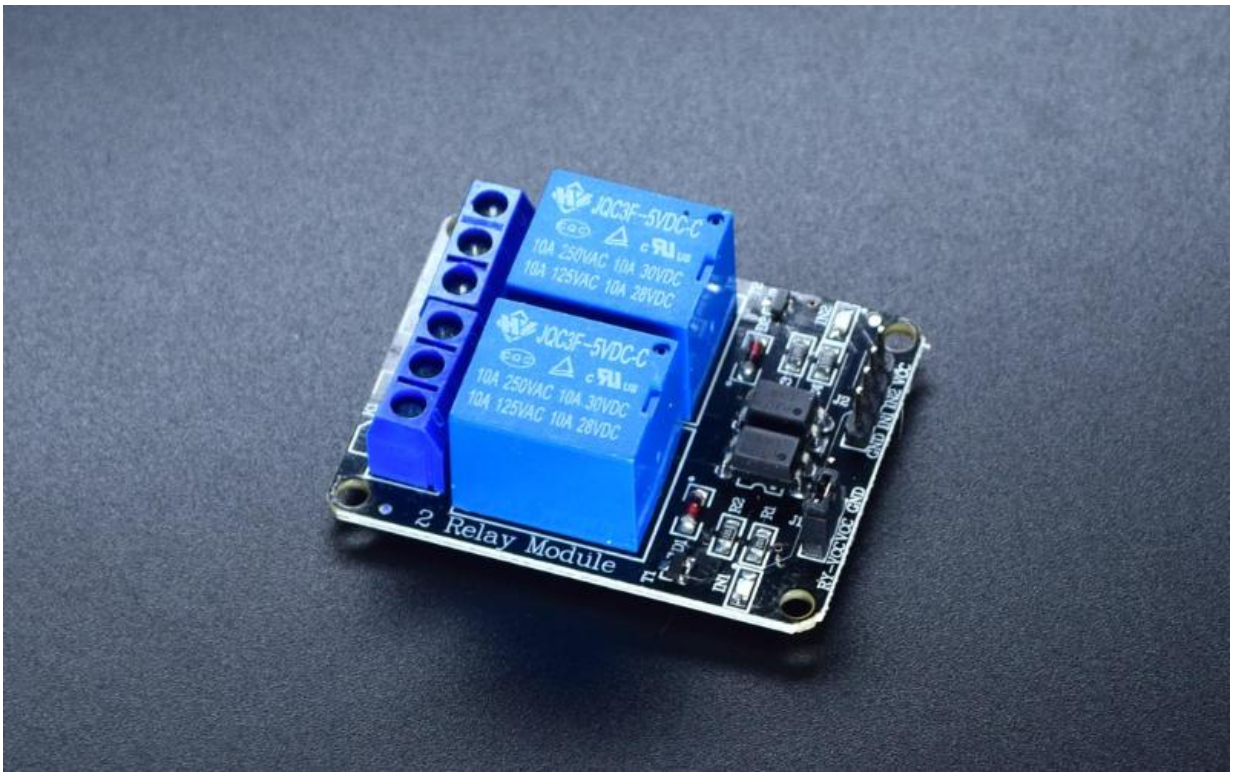
4. NEO 6 M GPS MODULE=

The Neo 6M GPS module is a compact, cost-effective GPS receiver widely used for various applications requiring precise GPS positioning. Developed by u-blox, a leading provider of positioning and wireless communication technologies, the Neo 6M module offers reliable performance in a small form factor, making it suitable for integration into a wide range of devices and systems.

Key features of the Neo 6M GPS module include:

1. **High Accuracy**: Provides accurate GPS positioning with a typical accuracy of a few meters, making it suitable for applications that require precise location data.
2. **Fast Time-to-First-Fix (TTFF)**: The module has a fast TTFF, allowing it to acquire satellite signals and determine its position quickly after power-up or when moving to a new location.
3. **Low Power Consumption**: Designed for efficiency, the Neo 6M module consumes minimal power, making it suitable for battery-operated devices and applications where power efficiency is critical.
4. **Serial Communication**: Communicates with a host microcontroller or computer via UART (Universal Asynchronous Receiver/Transmitter) interface, using a simple command set to retrieve GPS data.

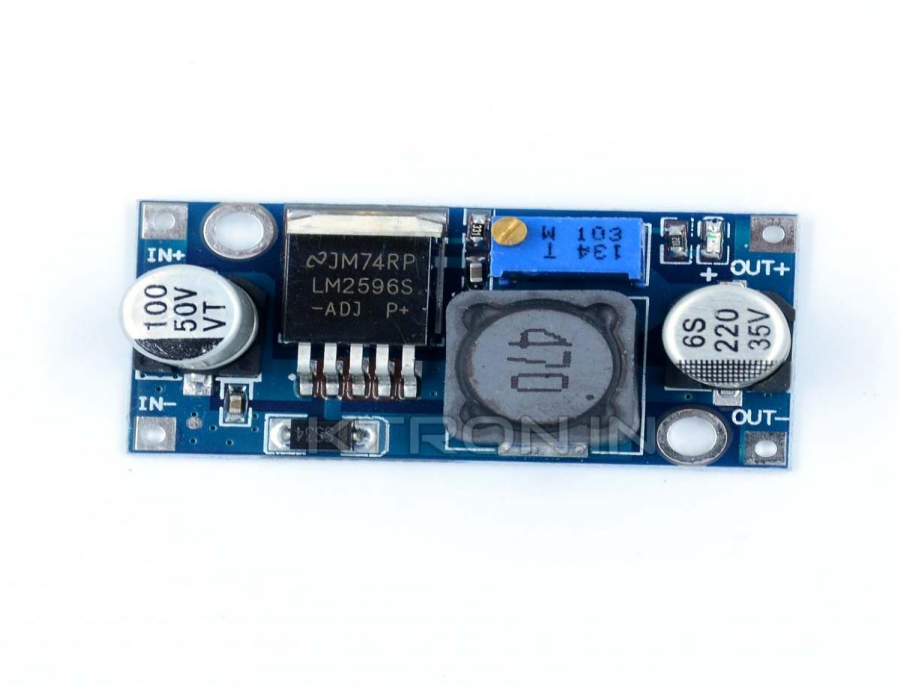
5. RELAY MODULE=



- The relay module in this project is used to control high-power devices such as the bike's ignition system and horn.
    - It acts as a switch that is controlled by the Arduino microcontroller.
- **Description**:
    - The relay module used is typically a 5V relay, compatible with the Arduino's digital output pins.
    - It consists of an electromagnet that, when energized by the Arduino, mechanically switches the high-power circuit on or off.

A Relay module is an essential electronic tool used in various devices to act as a switch between low-powered digital electronics and high-powered devices. It allows digital circuits and microcontrollers like Arduino to control motors or lighting circuits.

6. LM2596 DC-DC BUCK CONVERTER=



- The LM2596 module is used to provide a stable and regulated voltage supply to power the SIM800L module.
- The SIM800L module requires a specific operating voltage (typically around 4.2V to 4.4V) for reliable operation and communication over the GSM network.

7. 2G SIM CARD=

-

The SIM800L module supports only 2G simcards thatswhy I am using VI sim card

WORKING PRINCIPLES

The project integrates various electronic components and modules to enhance the security and functionality of a bike through remote monitoring and control capabilities. The key components and their working principles are outlined below:

1. **Arduino Microcontroller**:
    - The Arduino serves as the central processing unit of the system. It coordinates the operation of all connected modules based on programmed logic.
    - It receives data from sensors (GPS and gyro sensor) and manages communication with the SIM800L module.
2. **GPS Module**:
    - The GPS module retrieves accurate real-time location data of the bike.
    - This data is processed by the Arduino to provide location-based services such as tracking and geofencing.
3. **Gyro Sensor Module**:
    - The gyro sensor detects changes in orientation or sudden movements of the bike.
    - When significant movement indicative of a fall or impact is detected, the Arduino triggers an alert or notification.
4. **SIM800L Module**:
    - The SIM800L module establishes a GSM connection for communication.
    - It sends location updates, sensor data, and alerts to a designated mobile application or server via SMS or GPRS.
    - Commands from the mobile application, such as remote ignition control or horn activation, are received and executed by the Arduino through the SIM800L module.
5. **LM2596 Module**:
    - The LM2596 module functions as a DC-DC buck converter to regulate the voltage from the bike's battery.
    - It provides stable and reliable power to sensitive components like the Arduino and SIM800L module, ensuring consistent operation despite fluctuations in the battery voltage.

Operational Flow:

- **Initialization**: Upon startup, the Arduino initializes all connected modules and sensors.
- **Data Acquisition**: The GPS module continuously retrieves location data, while the gyro sensor monitors the bike's orientation.
- **Event Detection**: The Arduino processes data from the gyro sensor to detect any sudden changes indicating a potential fall.
- **Communication**: Using the SIM800L module, the Arduino sends location updates and sensor data to the user's mobile application or server.
- **Remote Control**: Commands received from the mobile application via SMS or GPRS are interpreted by the Arduino to control the bike's ignition and horn.
- **Alerts and Notifications**: In case of emergencies or abnormal events (e.g., bike fall detected), alerts are sent to predefined contacts.

Conclusion:

The integration of these components into a cohesive system enables enhanced security and control functionalities for bikes, empowering users with real-time monitoring, remote control, and instant alerts. This project demonstrates the application of IoT and GSM technologies to improve bike safety and management.

ARDUINO CODE

```
#include <SoftwareSerial.h>

#include <TinyGPS++.h>

#include <Wire.h>
```

```
#define SIM800_RX_PIN 8
#define SIM800_TX_PIN 7
#define GPS_RX_PIN 10
#define GPS_TX_PIN 11
#define GSM_BAUDRATE 9600
#define GPS_BAUDRATE 9600

SoftwareSerial sim800Serial(SIM800_RX_PIN, SIM800_TX_PIN);
TinyGPSPlus gps;

void setup() {
  Serial.begin(9600);
  sim800Serial.begin(GSM_BAUDRATE);
  Serial3.begin(GPS_BAUDRATE);
  Wire.begin();
}

void loop() {
  while (Serial3.available() > 0) {
    gps.encode(Serial3.read());
  }

  if (gps.location.isValid()) {
```

```
    Serial.print("Latitude: ");
    Serial.println(gps.location.lat(), 6);
    Serial.print("Longitude: ");
    Serial.println(gps.location.lng(), 6);
  }

  if (millis() % 10000 == 0) {
    sendLocationSMS();
  }

  if (sim800Serial.available() > 0) {
    String message = sim800Serial.readString();
    // Process SMS commands
  }

  delay(1000);
}

void sendLocationSMS() {
  sim800Serial.println("AT+CMGF=1");
  delay(100);
  sim800Serial.print("AT+CMGS=\"+1234567890\"\r"); // Replace with your
phone number
```

```
  delay(100);
  sim800Serial.print("Current Location: ");
  sim800Serial.print("Lat: ");
  sim800Serial.print(gps.location.lat(), 6);
  sim800Serial.print(", Long: ");
  sim800Serial.print(gps.location.lng(), 6);
  sim800Serial.println(char(26));
  delay(100);
}
```

QR CODE

CONCLUSION

In conclusion, the developed bike monitoring and control system represents a significant advancement in enhancing bike security and management through integrated IoT technologies. By leveraging components such as Arduino microcontroller, GPS module, gyro sensor, SIM800L module, and LM2596 voltage regulator, the system achieves several key functionalities:

1. **Remote Monitoring**: The GPS module provides real-time location tracking of the bike, enabling users to monitor its whereabouts remotely through a mobile application or SMS alerts.
2. **Fall Detection**: Utilizing the gyro sensor, the system can detect sudden movements or falls of the bike, triggering immediate alerts to notify the owner or designated contacts.
3. **Remote Control**: Through the SIM800L module, the system allows for remote control functionalities such as remotely activating the bike's ignition system or horn via SMS commands.
4. **Power Management**: The LM2596 module efficiently regulates the bike's battery voltage to ensure stable and reliable power supply to all connected components, minimizing operational risks and maximizing device uptime.
5. **Integration and Scalability**: The seamless integration of these components into a cohesive system demonstrates its potential for scalability and adaptation to various bike security and management applications.

In addition to enhancing bike security, the project underscores the application of IoT technologies in improving user convenience and safety. Future enhancements could explore additional features such as advanced analytics, remote diagnostics, and integration with cloud platforms for data storage and analysis.

Overall, the bike monitoring and control system not only meets the initial project objectives but also sets a foundation for further innovation in the field of smart vehicle systems.

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