SMART ARDUINO
HELMET

RESQNET

PROJECT REPORT

ENHANCED SAFETY
FOR CYCLISTS

PREPARED BY
GROUP 19

TECHNICAL REPORT FOR ARDUINO SMART HELMET

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Abstract

The Smart Boda Helmet is a low-cost embedded system designed to enhance road safety for motorcycle riders in Uganda. Boda bodas are a crucial form of transport but also contribute significantly to road accident statistics. This project addresses the lack of real-time crash detection and emergency response by integrating sensors and communication modules into a helmet using Arduino. The system detects crashes, monitors rider inactivity, and sends emergency SMS alerts. With plans for future GPS integration, this project aims to bridge the safety gap for vulnerable road users.

1. Introduction

This document outlines the technical and functional details of the Smart Boda Helmet project, a prototype developed as part of CSC 1304. It describes the user challenge, project objectives, the implemented solution, and system behavior. The project aims to solve real-world problems using embedded systems and practical skills in programming, electronics, and prototyping.

1.1 User Challenge

Motorcycle riders (boda bodas) face frequent and often fatal accidents in Uganda. Many ccidents occur in areas where help is not readily vailable, leading to delayed medical assistance. Current safety equipment lacks automation for emergency alerts, and imported smart helmets are unaffordable for most riders. There is a critical need for a local, affordable solution to bridge this gap in road safety.

1.2 Project Goals

The Smart Boda Helmet aims to improve rider safety by automatically detecting crashes and sending emergency alerts via SMS. Built using Arduino and sensors, the helmet monitors rider movement and triggers alerts if unusual impact or inactivity is detected. It also provides a button nterface for manual activation or cancellation of lerts. The helmet preserves comfort, safety, and ffordability while addressing the pressing need for timely accident response.

1.3 Functional Requirements

Crash Detection:

Monitor head movement using MPU-6050 (gyroscope + accelerometer).
Detect sudden impacts or abnormal tilts.

Inactivity Monitoring:

If no movement is detected within 10-15 seconds, trigger emergency alert sequence.

Emergency Communication:

Use SIM800L GSM module to send SMS to preset contacts.
Customizable message: "USER NEEDS HELP."

User Button Interface:

Short press = manually send alert.
Double press = cancel pending alert (for false alarms).

Power Management:

Rechargeable battery-powered system.
Internal wiring for safety and comfort.

2. Project Results

2.1 Product Design

System Architecture Components:

MPU-6050 Sensor **- Detects orientation and motion.**

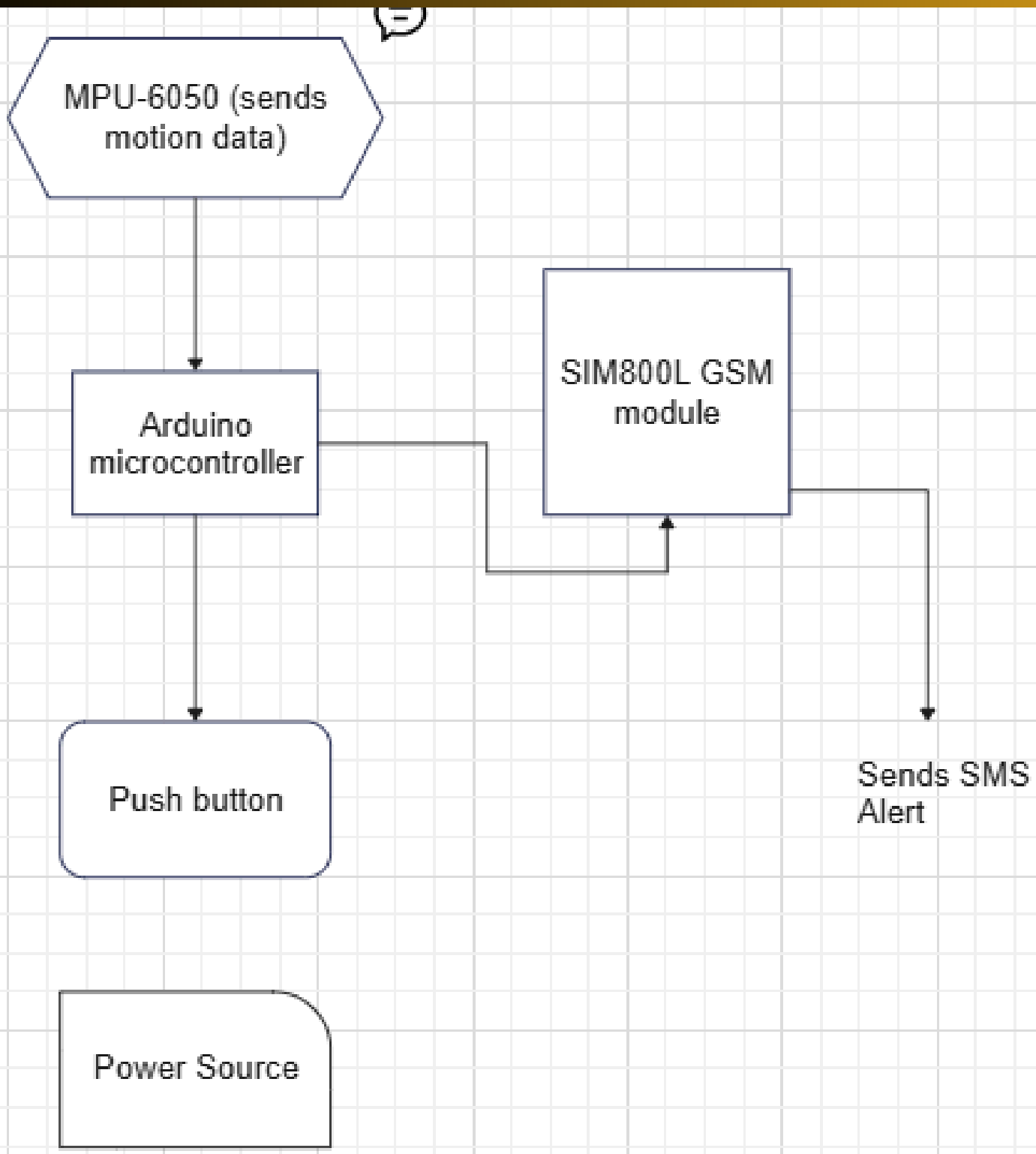
Arduino Nano/Uno **- Microcontroller for processing.**

SIM800L GSM Module **- Sends SMS alerts.**

Button Module **- Provides user control.**

Battery Pack **- Powers the entire circuit.**

Helmet Padding Integration **- Ensures discreet installation and comfort.**


MPU-6050 (sends motion data)
Arduino microcontroller
SIM800L GSM module
Push button
Sends SMS Alert
Power Source

2.2 Product Functionality and Screenshots

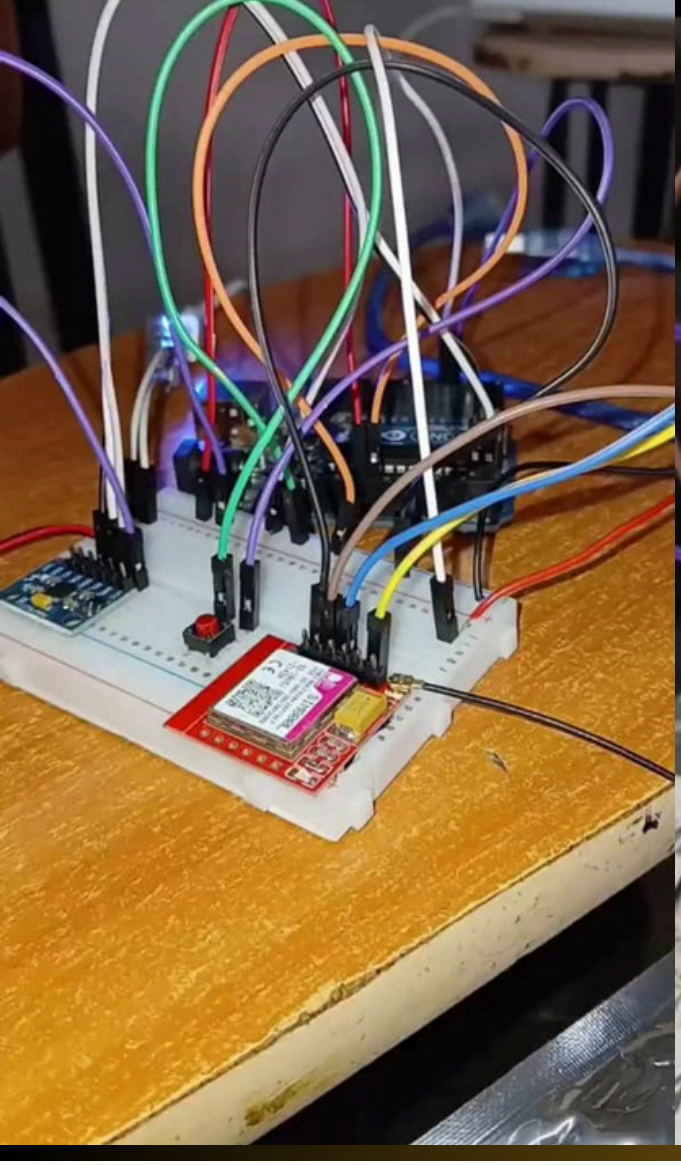
Functionality:

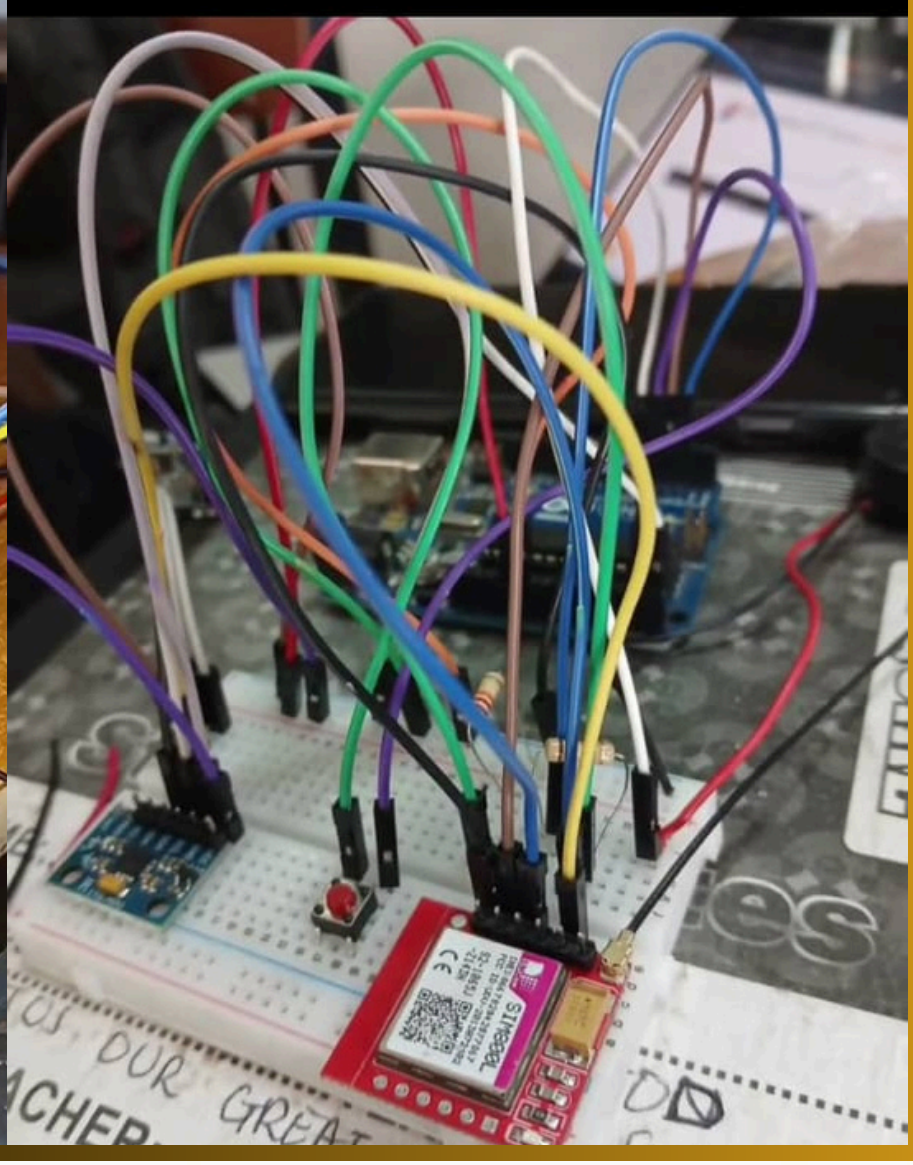
System boots up and monitors rider movement.

Upon impact, a timer begins.

If no movement is detected, SMS is triggered.

Button can override alert sequence.





user needs help 2:18 PM

null - 0.332236,32.570352:
Emmanuel Clinic - 911
Sky Phamacy - 911
Kadic Clinic Balintuma road - 0784 893318

2:18 PM

2.3 Project Website and Repository

GitHub Repository:

https://github.com/tusiim3/ResQnet.git

Project Demo Page:

https://tusiim3.github.io/Smart-Arduino-Helmet-site/

3. Limitations and Next Steps

3.1 Limitations

Battery needs to be fully charged at all times(not allowed to go below 3.7V) otherwise the sim800L cannot communicate

False alerts may occur if helmet is dropped.

3.2 Next Steps

Conduct real-world testing with actual riders.

GANTT CHART

	Task	Week 1	Week 2	Week 3	Week 4	Week 5	Week 6	Week 7
2	Project Planning & Research	✓						
3	Component Sourcing		✓					
4	System Design & Architecture			✓				
5	Prototyping				✓			
6	Coding & Testing (Phase 1)					✓		
7	Coding & Testing (Phase 2)						✓	
8	Integration into Helmet						✓	
9	Documentation & Report Writing							✓
10	Presentation Preparation							✓

	Team Member	Contribution
1	Tusiime Mark	Coding, Sensor Integration, Hardware Testing
2	Okure Enock	GSM Communication Module, Power Management
3	Namuyimbwa Martha	Documentation, arduino functionality code
4	Ayebare Atuhaire Eunice	System Logic Design, mobile application,poster
5	Weredwong J. Precious	Website design, mobile application, coding