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DEPARTEMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING
OPTION: ELECTRICAL TECHNOLOGY

FINAL YEAR PROJECT:

DESIGN AND IMPLEMENTATION OF POWER SUPPLY INDUSTRIAL INTELLIGENT ANTI -THEFT SYSTEM

The Final Year Project submitted in partial fulfillment of the requirements for the award of Advanced Diploma in Electrical Technology

Submitted by:

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Kigali, October 2024

DECLARATION A

I, KALISA JEAN LUC, hereby declare that this research proposal submitted to the Department of Electrical and Electronics Engineering at ULK Polytechnics Institute is my original work. It has never been presented for any academic award in whole or in part at this school or any other university, college, or higher learning institution.

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Supervisor name: _____

Sign: _____ Date: _____

DECLARATION-B

I confirm that the work reported in this research project was carried out by the candidate under my supervision and it has been with my approval as the UPI supervisor.

Supervisor name: Eng .Isaac TUMWINE

Signature:

Date:……/……/2024

DEDICATION

To the almighty God

To my parents and family

To my friends and colleagues

To the entire staff at large of the UPI

ACKNOWLEDGEMENT

I extend my heartfelt gratitude to my parents, whose unwavering guidance and support have always been my compass. Their encouragement gave me the strength and resources I needed to pursue my education with courage and determination.

I also express my appreciation to my government for its efforts in improving the quality of education and ensuring peace, allowing us to study without fear or interruption.

A special thanks to ULK Polytechnic Institute and my lecturers for providing us with the knowledge and tools that have shaped our educational journey. Now that this mission has reached its conclusion, I am truly grateful to all who have played a part in this achievement.

ABSTRACT

The design and implementation of a power supply industrial intelligent anti-theft system aim to provide a robust solution for protecting critical infrastructure from unauthorized access and theft. Industrial facilities often house valuable equipment and materials, making them susceptible to theft and vandalism. This project proposes an integrated system combining advanced sensor technologies, real-time data analysis, and remote monitoring capabilities to enhance the security of power supply systems in industrial environments.

A variety of sensors, including vibration, motion, and tamper detection devices, are included into the system design and are positioned strategically around important asset Arduino is central microcontroller that interprets data and sounds an alarm in the event of suspicious activity is connected to these sensors. The communication module makes use of technologies including GPRS, LoRa, and GSM.

To guarantee ongoing operation during power outages, the system also integrates a dependable power management technique with backup options like solar panels or batteries. The software interface enhances situational awareness and decision-making by offering users real-time monitoring, historical data analysis, and alarm management through a mobile application or web platform.

This advanced anti-theft system is suited for a range of architectural situations due to its scalable, flexible, and adaptive nature. Apart from safeguarding the material assets, it discourages potential pilfers by proactive observation and emergency call handling via mobile phone. Installing such a system is anticipated to significantly reduce theft-related losses and improve the overall security posture of assets in residential or commercial buildings.

Keywords: power supply, industrial, intelligent, anti-theft system.

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LIST OF ACCRONYMNS AND ABBREVIATIONS

GSM: global system for mobile network

AC: alternating current/voltage

DC: Direct current/voltage

LED: light emitting diode

IoT: Internet of things

CCTV: Closed circuit television

ESS : Electronic Security Systems

SMS: Short Messaging Service

GPRS: general packet for radio service

Wi-Fi: wireless fidelity

IEEE: institute of electrical and electronics engineering

LCD: Liquid crystal display

GND: Ground

CHAPTER 1:
GENERAL INTRODUCTION

1.0 Introduction

Welcome once again for everyone who persuade to read this project report which contains the amazing technology that can help everyone to protect his /her residential or commercial buildings. With this chapter one the objectives, problem statement and other points which gives pre understanding of this project is written in this chapter so we can know more as we continue to read whole book.

1.1 Background of the study

The issue with residential and commercial buildings is not new; it has existed for a number of years. For this reason, CCTV was created in the fifteenth century to help with home security after studying how the system operated, it was discovered that the UPS system needed to be linked into this security system in order to maintain appropriate operation and expand its functionality.

Traditional security methods, such guards, fences, and simple alarm systems, frequently don't work well enough to discourage or stop damage and theft. Furthermore, it is expensive and impracticable to continuously monitor industrial facilities by human means due to their large size and frequently remote locations. Because of this, more sophisticated and clever anti-theft systems that can offer real-time monitoring and quick reaction times have had to be developed..

Smart security systems that can automatically detect and respond to threats are becoming more and more popular as a result of the Internet of Things (IoT) and advances in sensor technology. To offer thorough coverage of important regions, these systems can include a variety of sensors, including motion detectors, vibration sensors, and video surveillance. Additionally, they have the ability to convey alerts to staff members directly or to distant monitoring stations using communication technologies like GSM, GPRS, or LoRa, allowing for quick action. (BARANI DESIGN Technologies s. r. o., 2019)

1.2 the problem Statement

Based on the data gathered from my research on security concerns in residential and commercial buildings, I discovered that despite increased measures to ensure reliable security, some gaps

persist. For instance, some families who hire domestic help encounter the issue of their servants robbing them, particularly when they leave the servants alone at home or at work allowing for quick action through personnel or remote monitoring stations.

Even wealthy families with CCTV systems installed in their properties have two major weaknesses, in my opinion. First, most CCTV systems have limited power, making it simple to penetrate the area these cameras are meant to cover when the main power source is cut off
Another flaw is that, in order to provide security, the camera records events on video, which necessitates that someone monitor the control room. As a result, this system is not appropriate everywhere because it cannot notify the building's owner when unexpected security concerns arise. It is also very large and sophisticated, and its operation depends on internet connectivity

1.3 Research objectives

1.3.1 General objective

The aim of this project is to design and implement a power supply industrial intelligent anti-theft system.

1.3.2 Specific objectives

The project specific research goals are as follows:

1. To ensure uninterrupted operation during power outages, design a system architecture that integrates automated UPS with home security sensors (such as smoke detectors, door/window sensors, and motion detectors).
2. To facilitate coordinated operation, implement a seamless link between the power management module and the security system.
3. To add a GSM module to the system so that it can communicate with the user in real time by sending SMS commands and alarms.
4. To Build an automated UPS system that can recognize power outages and automatically transition to backup power sources (such as generators or batteries) without the need for human involvement.

1.4 Research questions

The following research questions have been developed in order to direct the investigation and accomplish the goals of the study:

1. How can an automated UPS system be integrated with home security sensors to ensure uninterrupted operation during power outages?

2. What are the most effective methods for creating a seamless link between the power management module and home security systems to enable coordinated operation?

3. How can a GSM module be incorporated into a home automation system to enable real-time communication with users through SMS commands and alarms?

4. What design features allow an automated UPS system to recognize power outages and seamlessly transition to backup power sources like generators or batteries without human intervention?

1.5 Scope and Limitations

1.5.1 Geographical Scope

Residential residents in located in GASABO district will be the study's primary emphasis, especially those who live in locations that frequently have power outages or who have security concerns.

While broad conditions that may be applicable to many regions will be considered, the research will not concentrate on legislation or requirements unique to any one region concerning power management and home security systems

1.5.2 Time scope

The parameters and boundaries that will govern the research will be established by the study's scope. Along with the research's restrictions and exclusions, it describes the particular features of the GSM-based intelligent home security system linked with an automated UPS system that will be covered in the period f 30 days in year of 2024

1.5.3 Content scope

Emphasis on GSM-Based Technology: The study's main focus will be on using GSM technology to remotely operate the home security systems and communicate in real time this scope excludes other communication technologies like Wi-Fi and Zigbee.

Integration of Security and with Battery UPS System: The primary objective is to provide asingle, integrated system that combines home security features like motion detectors,

door/window sensors, and smoke detectors with an automated UPS power source for a consistent power supply during blackouts

1.6 Limitations

The project on the design and implementation of a GSM-based intelligent home security system integrated with an automated Uninterruptible Power Supply (UPS) system faces several limitations that could impact its execution, effectiveness, and sustainability. These limitations are important to consider as they provide context for the project's outcomes and guide future improvements. Here are the primary limitations:

1.6.1 GSM Dependency

The system relies heavily on GSM networks for communication. In areas with weak or no GSM coverage, the functionality of the security alerts may be compromised, limiting the system's effectiveness for certain users.

1.6.2 Battery Life and Performance

The performance of the UPS is contingent on the quality and maintenance of the batteries. Variability in battery performance can affect the system's reliability during power outages.

1.6.3 Limited Testing Scope

The project may be implemented in a limited geographical area or within specific types of households, which may not accurately represent the needs and challenges of diverse environments.

1.6.4 Feature Limitations

The project may focus on specific features, leaving out other potential enhancements that could improve overall functionality or user experience.

1.7 Significance of the study

Due to the technology and performance of our system the achievement of objectives of project has the significate to the following:

1.7.1 To the Researcher

I. **Technical Expertise:** The research involves hands-on experience in designing and implementing both hardware and software components of the system, allowing the

researcher to deepen their technical skills in electronics, programming, and system integration.

II. **Problem-Solving Abilities:** The process of addressing design challenges and troubleshooting issues during implementation enhances critical thinking and problem-solving skills, which are valuable in both academic and professional settings.

1.7.2 To the community

I. **Reduction in Crime Rates:** By promoting the use of intelligent home security systems, the study contributes to a safer community. Increased adoption of such systems can deter criminal activities, leading to lower crime rates and enhanced public safety.

II. **Rapid Response to Emergencies:** The integration of real-time alert systems means that emergency services can be notified promptly in case of security breaches or hazardous situations (e.g., fire, gas leaks), resulting in quicker response times and potentially saving lives and property.

1.7.3 To ommunity and Public Institutions (CPI)

I. **Improved Emergency Response:** The integration of real-time alert systems allows for quicker notification to law enforcement and emergency services, enhancing their ability to respond to incidents effectively and efficiently. This can lead to improved outcomes in emergencies

II. **Data-Driven Decision Making:** The system can generate data on security incidents and power outages, which can be valuable for public institutions to analyze trends and allocate resources more effectively in crime prevention and disaster management

III. **For home buildings security:** as this project provides advanced and cheap technology of protecting buildings the security of this area is increased so that everyone who will chose this system his building will be completely safe

For **commercial activities** the losses caused by thieves will be reduced

1.8 Organization of the study

This project report has five chapters which show how the project will be implemented from start to end so the role of each chapter is described as follow:

Chapter one: **general introduction** in this chapter contains the briefly understanding about our project, the main objectives and problem statement of project is described in this chapter one

Chapter two: literature review: This section deals with the analysis of the literature related to the subject of the study with the objective of seeing the concepts, It should show relationships identified by previous researchers

chapter three: research methodology this section contains I strategy used in the study. It shows quasi-experimental, descriptive survey, historical, ex post facto, action research, evaluation research, etc.

chapter four: system design , analysis and implementation): this chapter contains implementation components such as description of components used in project ,circuit diagram and prototype.

chapter five: conclusion and recommendations this is last chapter of our projects which shows the conclusion and recommendation, simply its give us information to ensure if objectives of project is achieved.

1.9 Summary

In conclusion therefore chapter one talked about; introduction, background to the study, problem statement, objectives, research questions, scope, significance of the study and the organization of the studies.

CHAPTER 2 :

LITERATURE REVIEW

2.1 Introduction

None person who can make strong infrastructure with his/her brain only, the ideas and advices from other people are necessary to increase experience about the product you want to produce

So this chapter contains the ideas from past researcher who worked on the project which seems to be like this project.

2.2 Concepts

Electronic Security Systems (ESS) are physical security systems deployed to integrate into a facility's necessary level of protection

The technology and sophistication of electronics has exploded. Digital cameras on cell phones and the Internet have affected everyone. It was not many years ago that a cell phone was a luxury; today it is becoming a necessity.

The Internet has become part of the majority of households to maintain the safety of their property even themselves either for residential or commercial buildings that why this we tried to improve this ant thief system to provide reliable solution.

2.3 Theoretical perspectives

Ant theft system which provide reliable solution to security breach it requires the system which works every day and every time that why to integrate industrial ups in this system is very necessary to increase the performance of electronic building security system

Security System Uninterruptible Power Supply Systems (Security System UPS Systems) are designed to provide clean, conditioned, uninterrupted power precisely for your security system.

We know that you care about up time on your security system. We also know your electric company can't always provide uniform power to all its customers while also focusing on mass distribution.

It's time to protect your investment in equipment and your security feeds from power outages, voltage drops/spikes, and other power issues.

2.4 Related study

The following are summaries from the documents of past research which worked to the ant theft and other electronic security system

So their ides supported us in developing our project and the gaps we found in their projects helped us to know what to add in this system to satisfy the need of community

2.4.1 Intelligent Anti-Theft System for Automobiles

These days all the car are outfitted with auto cop systems. Despite the fact that, the criminals are breaking the obstructions and take the vehicles. (B. Jhony1, SPTEMBER 2016) This venture is the right answer for this issue. Utilizing this venture, one can control his vehicle's car engine by method for a SMS.

Hence, to conquer the above disadvantages, we are utilizing one of the remote correspondence procedure i.e., GSM (Global System for Mobile communications) is a digital cellular communications system which has quickly picked up acknowledgment and piece of the pie around the world. ARM is the heart of the task. A GSM modem is interfaced to microcontroller

2.4.2 Design and construction of a remotely controlled vehicle anti-theft system via gsm network

Remotely controlled vehicle anti-theft system via GSM network is a system that explores the GSM network in order to produce a reliable and efficient vehicle security system. However, the design project can be viewed from two perspectives viz the hardware consideration and the software consideration (K.S. Alli (1), 5 May 2015). Minicom which is a terminal emulation program on Linux was utilized for the configuration of the Modem used in this project work due to its inherent advantages.

Communication between the user and the vehicle sub-system is via sms (Short Messaging Service) messaging. SMS commands are sent to the GSM/GPRS Modem Module. The GSM/GPRS interpretes the message and performs necessary control actions.

Also, sms messages are sent from the GSM/GPRS Modem Module to the user's mobile phone whenever an alarm situation occurs. However, a toy car was used as a prototype display of this project work and prototype car was immobilized and demobilized from a mobile phone via SM

2.4.3 Design and Prototyping of Sensor-based Anti-Theft Security System using Microcontroller

To address the safety of the home or other facility, a microcontroller-based solar-powered anti-theft automated security system is developed with arrays of sensors to detect possible intrusion incidents. (Ahmed, 03, March-2021)The designed system produces three kinds of alarms (Buzzer, bi-color LED, and SMS) with a security breach notification through an LCD, based on the data from its interfaced sensors (Motion Sensor, Fire Sensor, and Glass-break Sensor)

The microcontroller used to control all aspects of the system is Atmega8. A Light Depended Resistor (LDR) and a Potentiometer (POT) are used to build the Motion Sensor; Temperature Detector LM35 is used as the Fire Sensor; and a sensitive metal strip is used to build a custom Glass-break Sensor. (Ahmed, 03, March-2021) SIM900 (GSM) is used to design an SMS generating system as one of the alarming methods. The designed system is found to be consumed very low power with a 5V supply since when it is ON, the bi-color LED (0.1watt) requires only 0.98μA and 23.5mA of current, and 4.88mW and 117.5mW of power during its state change; and the Buzzer consumes only 0.49mW of power when it is ON. The system is designed with the consideration of incorporating a double-grid power management system, and a dedicated Sun-tracking solar power system is designed to increase its overall efficiency and sustainability. The whole system is designed and verified using 'Proteus 7.7 Professional' and the core part of the system is physically constructed and tested. The programming of the Atmega8 is done using 'Code Vision AVR version 2.5 Professional

2.4.4 IoT based anti theft system for home

The project aims to design a framework for providing a house owner/member with the immediate notification of an ongoing theft or unauthorized access to their premises. For this purpose, a rigorous analysis of existing systems was undertaken to identify research gaps. The problems found with existing systems were that they can only identify the intruder after the theft, or cannot distinguish between human and non-human objects. (Shamita2, 10 | Oct 2021)

Wireless Sensors Networks (WSNs) combined with the use of Internet of Things (IoT) are expanding smart home concepts and solutions, and their applications.

This project proposes a novel IOT based smart home anti-theft system that can detect an intruder. The fundamental idea isto design a cost-effective and efficient system for an individual to be able to detect any kind of theft in real-time and provide instant notification of the theft to the house owner. The system also promises to implement home security with large video data handling in real-time.

2.4.5 IoT Based Anti-Theft Detection and Alarm System Using NodeMCU and Blynk Application

The purpose of building this system Was to prevent the loss of property due to theft that we face in our daily lives. This system includes NodeMCU with Esp8266 Wi-Fi module based on microcontroller, PIR sensor to use the motion detection, ultrasonic sensor to know the distance from the obstacles, buzzer to use the alarm system, Blynk application to use the reporting message and light bulb to illuminate around the environments (prevent, Aug 2022).

When sensor detected the movement of objects, sends a message to phone, lights up the bulb, and then alert alarm because Esp8226 Wi-Fi module is connected to Blynk application. The problems found with existing systems were that they can only identify the intruder after the theft, or cannot distinguish between human and non-human objects. So, this system will be essential for every building because it is not just easy to use but is also inexpensive.

2.4.6 Intelligent Anti-Theft System for Automobiles

Security is prime sympathy toward everybody. These days all the car are outfitted with auto cop systems. Despite the fact that, the criminals are breaking the obstructions and take the vehicles. This venture is the right answer for this issue (Jhony1, september 2016). Utilizing this venture, one can control his vehicle's car engine by method for a SMS.

2.4.7 Conceptual Framework

The aim of the project is an anti-theft system that includes power supply backup with intelligent security mechanisms that, in case of a power supply failure, guarantee protection against theft or unauthorized access to fundamental industrial and commercial systems.

In this framework, one can see how such different components-sensors, communication technologies, and power management-work together to provide a robust security solution.

2.4.8 Independent Variables:

These are the factors or components you will manipulate or include in your system, as they directly influence the functionality and performance of the anti-theft system.

1. Power Supply Components:
   - Uninterruptible Power Supply (UPS): Provides backup power during outages.
   - Solar Panels or Batteries: Acts as additional backup systems to ensure continuity.
2. Sensors:
   - Vibration Sensors: Detect tampering or movement around critical assets.
   - Motion Detectors: Detect unauthorized entry or movement within the premises.
   - Tamper Detection Devices: Identify when protected equipment or enclosures are accessed inappropriately.
3. Communication Technologies:
   - GSM/GPRS Module: Sends alerts to the user in real-time when the system detects security breaches.
- LoRa Technology: Facilitates long-range wireless communication to monitor remote industrial locations.
4. System Management and Control:
   - Arduino Microcontroller: Processes sensor data and controls system behavior (e.g., sounding alarms or switching power sources).
   - Alarm Systems (Buzzers/Sirens): Activated when unauthorized activity is detected.
   - Mobile/Web Platform Interface: For remote monitoring, data visualization, and system management.

2.4.9 Dependent Variables:

These are the outcomes that are influenced by the independent variables. They represent the performance and effectiveness of the anti-theft system.

1. Security Effectiveness:
   - Measured by the system's ability to detect unauthorized activity and prevent theft.
   - Number of theft incidents before and after system implementation.

2. System Reliability:

- Reflected in the system's uptime and effectiveness during power outages, monitored through real-time data on backup power use.

- Number of false alarms vs. real security incidents detected.

3. Communication and Response Time:

- Speed at which the system sends alerts (SMS, alarms) after detecting suspicious activity.

- Time taken to notify the system owner after detecting a security breach.

4. User Satisfaction and Adoption:

- Based on feedback from users about system usability, real-time notifications, and overall system performance.

- User retention and the likelihood of expanding system use across multiple sites.

2.5 Component used for implementation

1. An uninterruptible power supply

(**UPS**) or **uninterruptible power source** is a type of continual power system that provides automated backup electric power to a load when the input power source or mains power fails.

This device stores power in battery then if the main supply fails to provide power to system that voltage stored in battery is converted into AC power to keep our system continuously working.

Figure 1: UPS

2. A contactor

A contactor is an electrical device that is widely used for switching circuits on and off. As such, electrical contractors form a subcategory of electromagnetic switches known as relays.

Contactor in our project is used in power circuit to supply electrical power to three phase motor

Figure 2: contactor

3. Auxiliary contact

an auxiliary contactor is a regular (low-power) relay - but built like a "regular" contactor and when used together with another contactor it is called auxiliary contactor to clarify that it is not used for switching loads but has an activation/deactivation or control function instead - used to connect/disconnect a circuit (in a nutshell: to control over in our circuit contacts

Figure 3: Auxiliary contactors

4. Relay module

The **relay** is an electromechanical switching device which can control the AC or DC devices through the 3V, 5v or 12v DC relay coil. It is equipped with high-current relay that work under AC250V 10A or DC30V 10A.

Relay in our system is controlling contactors by using signal from micro controllers

Figure 4: relays module

5. Arduino Uno

Arduino Uno is a microcontroller board based on the ATmega328P (datasheet). It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz ceramic

resonator (CSTCE16M0V53-R0), a USB connection, a power jack, an ICSP header and a reset button.

It contains everything needed to support the microcontroller; simply connect it to a computer with a USB cable or power it with a AC-to-DC adapter or battery to get started.. You can tinker with your Uno without worrying too much about doing something wrong, worst case scenario you can replace the chip for a few dollars and start over again.

In our system Arduino Uno is hosting microcontroller which is processing the data in the system

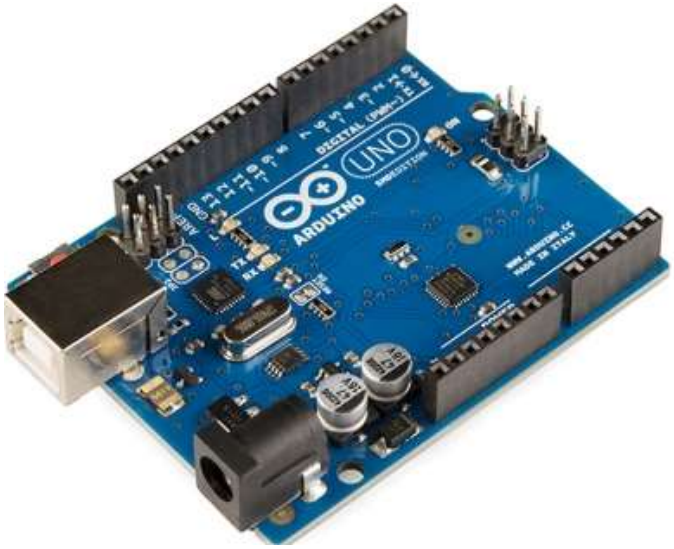

Figure 5: Arduino Uno

6. Module GSM

A GSM module or a GPRS module is a **chip or circuit that will be used to establish communication between a mobile device or** a computing machine

he GSM module plays a crucial role in the communication between devices and the GSM network. It is responsible for establishing and maintaining the communication link between the device and the network. The module also handles the encryption and decryption of data, which ensures the security of the communication

in our system GSM is used to drive alert message to the ouner of building when the security of that building is breached

Figure 6: GSM Module

7. Ultrasonic sensor

An ultrasonic sensor is an electronic device that measures the distance of a target object by emitting ultrasonic sound waves, and converts the reflected sound into an electrical signal.

In order to calculate the distance between the sensor and the object, the sensor measures the time it takes between the emission of the sound by the transmitter to its contact with the receiver.

The formula for this calculation is $D = \frac{1}{2} T \times C$ (where D is the distance, T is the time, and C is the speed of sound ~ 343 meters/second).

For example, if a scientist set up an ultrasonic sensor aimed at a box and it took 0.025 seconds for the sound to bounce back, the distance between the ultrasonic sensor and the box would be:

D = 0.5 x 0.025 x 343 or about 4.2875 meters.

Figure 7: Ultrasonic sensor

In our system ultrasonic sensor is considered as ant theft intelligent sensor which is placed near protected item inside the building so that if un authorized person remove that item in its position the message given to the owner to give information.

8. Printed circuit board

This is device on which electronic components are fixed together to form the complete system

Figure 8: PCB BOARD

9. Magnetic Reed switch

This is Reed Switch 2 x 14 mm Magnetic Control Switch with Normally Open Contact.

When the device is exposed to a magnetic field, the two ferrous pins inside the switch pull together and the switch closes. When the magnetic field is removed, The Reed Switch separates and the switch opens. This makes for a great non-contact switch. This switch can carry up to 1.2A.

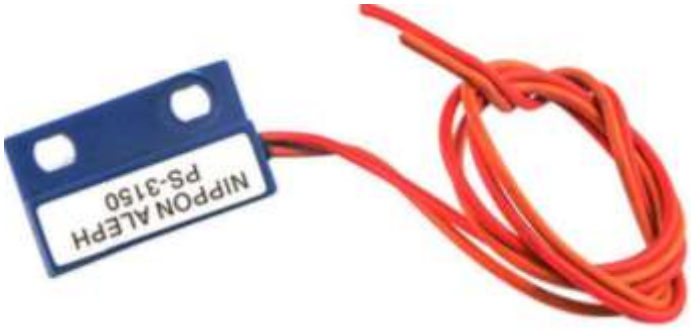

Figure 9: 12 reed switch

This component is used to the theft from entering in the certain room of any building protected by our system

This small and easy to use module can be used in a variety of environmental conditions, it operates very reliably in the -50°C to +140°C temperature range

10. Permanent magnet

This a special disc magnet which can be used in making small power generator and also there are used in speaker and CD ROM, Magnets are a simple, reliable way to latch doors on refrigerators and cabinets

Figure 10: magnet

In our system these permanent magnets are used to control reed switch.

11. Common Cathode RGB LED

This is a 8mm RGB LED (Red Green Blue) with four pins. Triple output with a common cathode, this RGB LED can be used for three status indicators or pulse width modulates all three and gets mixed colors!

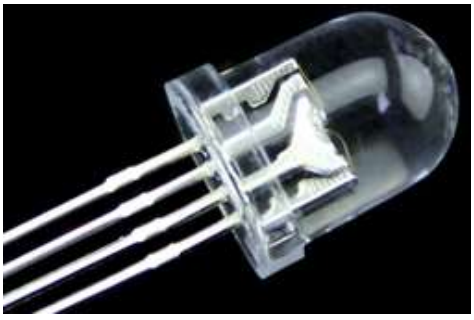

Figure 11: 14 RGB LED

12. Buzzer

This is a Buzzer device that is used to provide audio signaling, Apply 5V to this buzzer module and you'll be rewarded with a loud noise.

Figure 12: buzzer

13. Horn Siren Home Security Sound Alarm System

At 120dbs, this siren will not only alert the neighbors of the intrusion, but scare away the burglar rightout ofy ourhouse!

This piercing, plug-in siren can be plugged into your keypad/Console.It works with your system, responding tosignals from an alerted Keypad/Console.

No intruder will hang around when one of these sirens sounds!

Figure 13: siren

14. Power dc adapter

Adapter charger 12 v DC is a type of external power supply often enclosed in case similar to an AC plug

Figure 14: DC Adapter

2.5 Summary

Focused on data collected from past researchers working on the same issue, we estimate that the majority of systems currently in use are mostly focused on local communication.

While some systems use Internet of Things technology, their high cost limits the number of users.

In addition, I saw several gaps in the current security application technology that need to be addressed. In conclusion, the deficiencies in both the current and prior systems provide us with opportunities that have led us to design this supply industrial intelligent ant theft system.

In conclusion therefore this chapter talked about; concepts, opinions, and ideas from authors/ experts and related studies.

CHAPTER 3 :
RESEARCH METHODOLOGY

3.0 Introduction

Research methodology is a way to systematically solve the research problem. It may be understood as a science of studying how research is done scientifically.

So in this chapter I discuss on the various steps that are generally adopted to provide the solution to the research problems

3.1 Research Design

Home security is the most vital aspect for every homeowner either in an individual house or an apartment. To get the absolute peace of mind whether you are at home or out of home you must ensure that your home is installed with the perfect home security monitoring system.

This power supply industrial intelligent ant theft system for wireless industrial and home security system can be used to provide security system for residential, industrial, and for all domestic and are described below :

3.2 Research population

The targeted population for this study involves individuals and entities that are exposed to a potential security risk as a result of constant power interruptions. Mainly, it includes residential home owners within Gasabo District, where the power cuts render usual security mechanisms ineffective, hence exposing homes to thieves. It also includes commercial and industrial facility managers whose operations require them to take measures to protect multimillion-dollar equipment in large, normally remote areas where around-the-clock human surveillance is impossible.

This population would also include security personnel and technicians who will install the anti-theft system so that it works correctly. There are also technology and security experts offering valued insights toward perfection in the design and functionality of the system, whether residential or industrial.

3.3 Sample Size

For the purpose of convenience and relevance to the research study, 163 respondents were sampled. A sample size of seven was presumed limited in number but capturing varied perspectives and expertise that could be overwhelming and difficult to analyze if the number is large. Although the findings may not be generalized, these could complement further research with an increased sample size.

3.3.1 Sampling Procedure

The sampling basis was purposive since the selected target audience had to be directly experienced in anti-theft systems and industrial security technologies. Invitations were sent directly, and professional networks were utilized to approach potential respondents individually, whose expertise would contribute to added value for this study.

3.4 Research Instrument

3.4.1 Choice of the research instrument

To have project idea the research is most important item in discovering what is in community and how to fill that gap found in community.

So the method I used to collect data which encouraged me to implement this project is the observation methods which I carried out in difference family and house located in Kigali

As illustrated in the problem statement the security of house while the owner are not around home is still having some gap so these observation I made helped me to study how I can fill this gap that why I decided to implements this system with industrial power back up system which is increase the performance and functionality of the system

3.4.2 Validity and Reliability of the Instrument

Data collected through observation can provide valuable insights into human behavior, preferences, and needs. However, observation data can also be prone to errors, biases, and misinterpretation. Therefore, it is essential to validate and verify the data to ensure its accuracy, reliability, and usefulness

I to insure validity of data I gained by using this method I used to ensure if the problem I found in both industrial and commercial building is really an issue for people

So with the interview sampling question I found that the problem is common to many people

Another way to validate and verify data collected through observation I checked for consistency and reliability of your data. Consistency means that your data is coherent and logical, and does not contain any contradictions or discrepancies. Reliability means that your data is stable and reproducible, and does not vary significantly due to random or systematic errors.

3.5 Data Gathering Procedures

Data was gathered through several steps:

1. Identification and Selection of Respondents: Respondents were chosen according to their knowledge and skill of airport runway lighting learners and radar technology.

2. Structured Interviews and Observations: These were conducted in several channel of communication to gather primary data on the current lighting programs for runways.

3. Questionnaires: These were administered to a variety of stakeholders to collect quantitative data through various networks.

The information was well structured and then summarized and analyzed.

3.5.1 Primary data

This was further supported by an enlightening visit to the local electronic workshop for expert guidance on components essential in the development of an anti-theft system. It engendered the assistant to give valuable information on the sizing, functionality, and applications of the components at hand, thus greatly adding to our practical knowledge. It developed the importance of this visit to ensure that the best choices are made regarding these components, which are required for the overall success and efficiency of the power supply anti-theft system.

3.5.2 Secondary data

The secondary data involved information previously collected and analyzed from various sources. Extensive research, by way of books and online materials, was done to implement the project and fill in the knowledge gaps in the design and implementation of the anti-theft system. We sought literature material specifically related to industrial security and anti-theft technologies that would add weight to our understanding. Thus, combining online research with the literature

review, along with supervision, proved to be a well-rounded body of secondary data for this project to stand on.

3.6 Data Analysis and Interpretation

Thematic analysis of qualitative data from interviews and observations were done in order to come up with common themes regarding issues that appeared helpful in showing the effectiveness of the intelligent anti-theft system. The process helped in identifying the key issues and trends related to the performance of the system.

Chi-square tests, correlation analysis, and ANOVA were employed for quantitative data analysis, which helped us in the evaluation of the working of this system. All these techniques helped us in finding answers to all our research questions or confirming the hypotheses.

3.7 Ethical considerations

The first step toward the ethical use of intelligent and theft system security is understanding the ethical considerations.

Privacy Concerns

While security systems do target criminals, they also target innocent people going about their daily life, monitoring them when they may not want to be monitored. This brings up confidentiality concerns, especially when a person may have their data logged into a security system.

3.7.1 False alarm protection

I set my detector at potential threats based on algorithms, this poses a serious issue concerning discrimination. Unfortunately, much of the time, sensors recognition bias targets marginalized communities.

3.7.2 Impact on Civil Liberties

There is a serious concern surrounding the impact of surveillance on civil liberties. While – yes – infrared from can make an area safer, it can also disrupt a person’s right to privacy.

All of these are serious concerns and things everyone must consider when investing in security technology. Below, find out how to ensure ethics in security can be prioritized. Don’t forget also to check out our blog, where you can discover more security technology tips and advice.

3.8 Summary

In conclusion, therefore this chapter talked about; introduction, research design, research population, sample size, sampling procedures, research instrument, data gathering procedures, data analysis and interpretation and ethical consideration.

CHAPTER 4 :

SYSTEM DESIGN , IMPLEMENTATION AND ANALYSIS

4.0 Introduction

This is the fourth chapter in our project research report it co contains the main point which shows how the final product from our research was implemented

4.1 Drawings

4.1.1 System block diagram

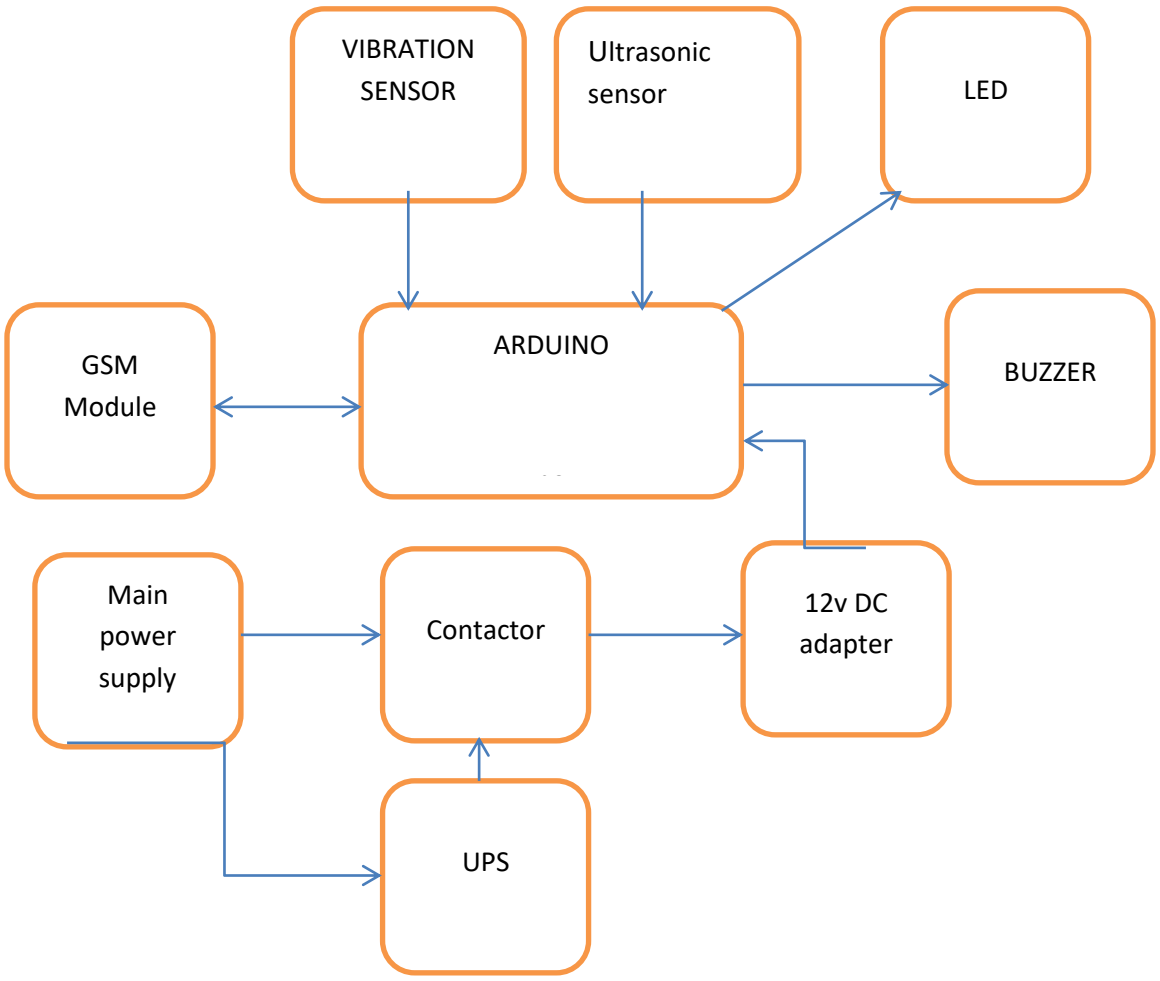

Figure 15: block diagram

4.2 FLOW CHART

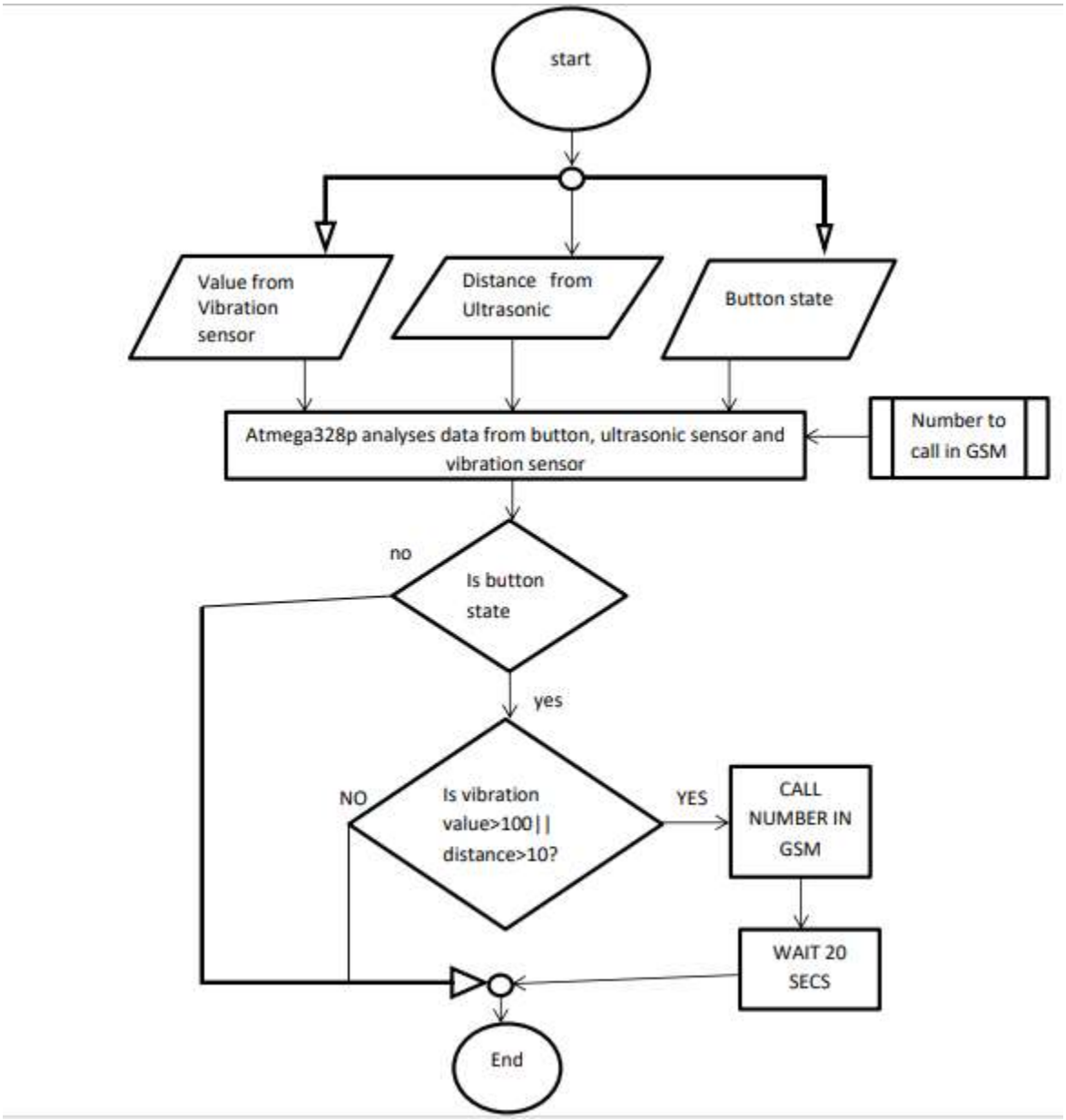

Figure 16: Flowchart

4.1.2 Anti-theft System circuit diagram

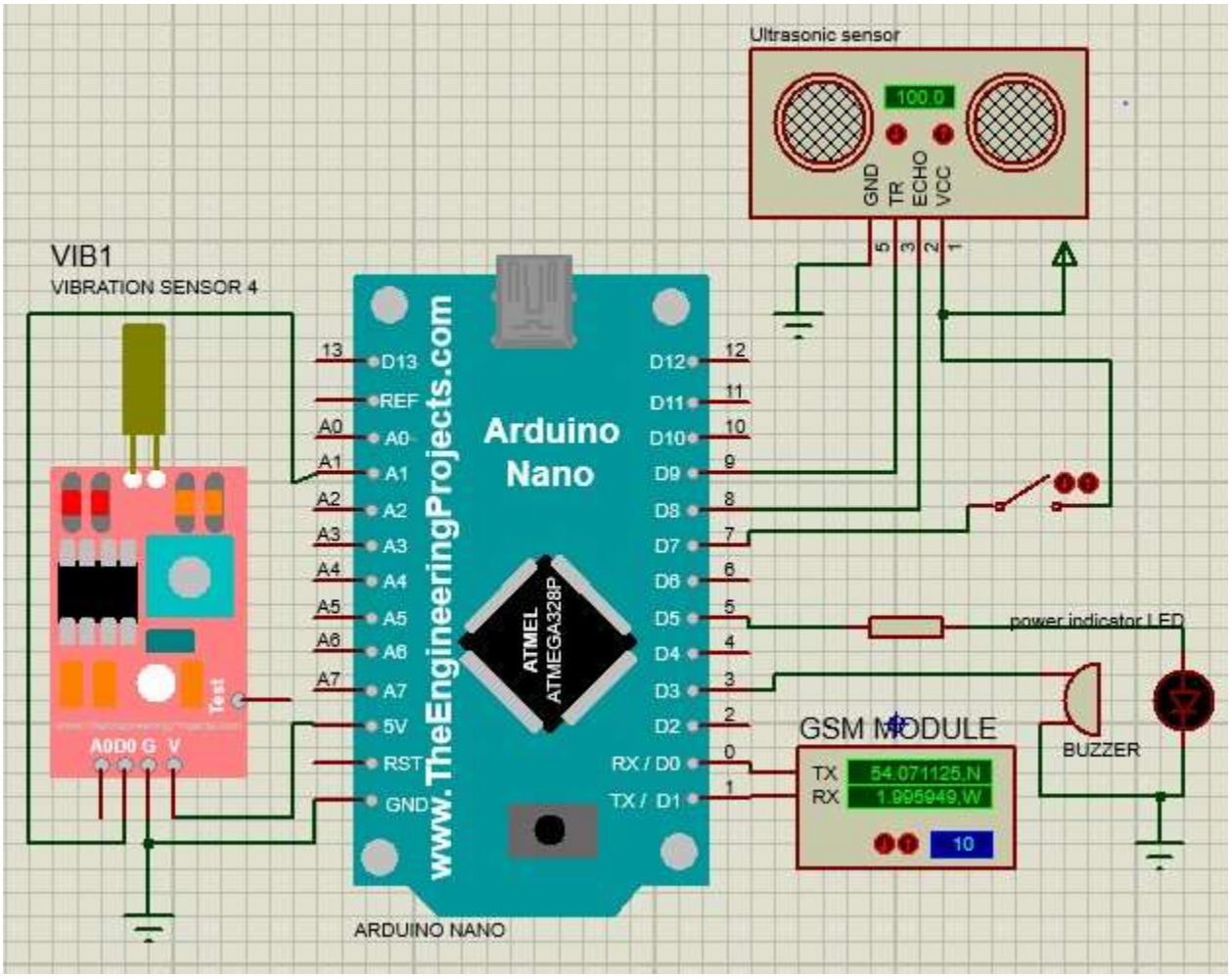

Figure 17: Anti-theft System circuit diagram

4.1.3 Electrical power backup System circuit diagram

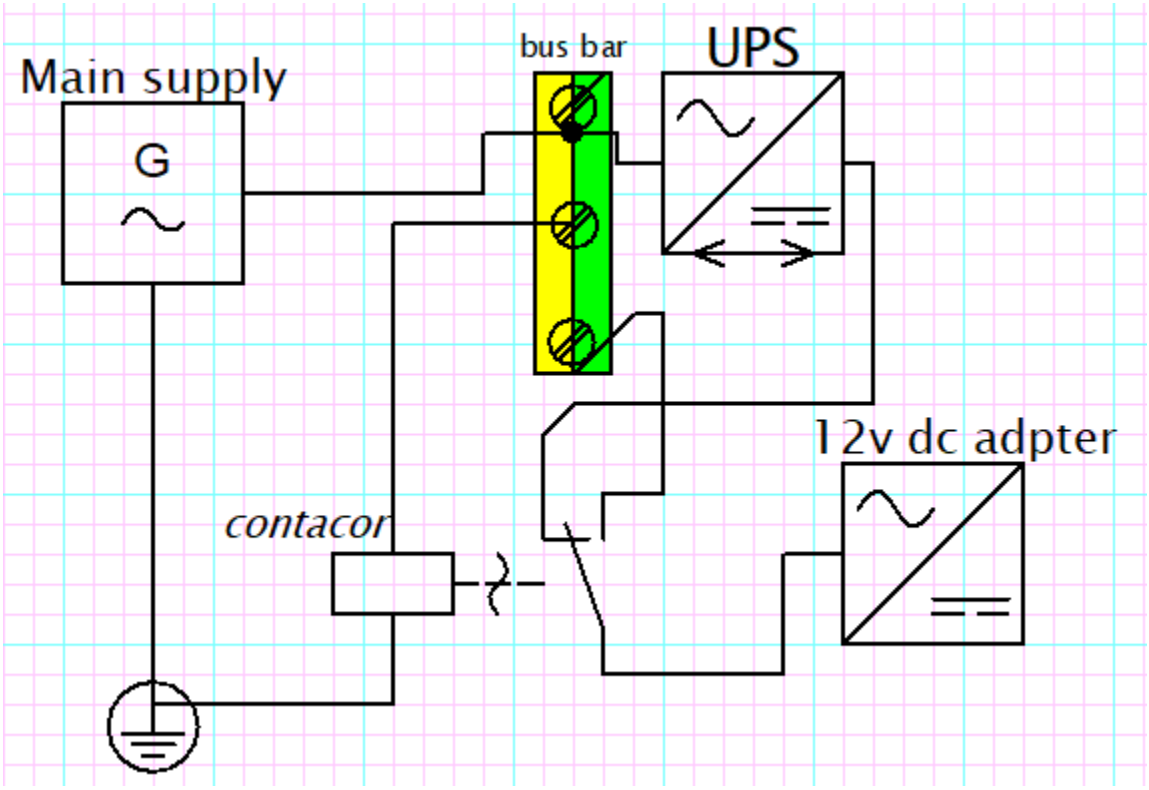

Figure 18: Electrical power backup System circuit diagram

4.2 SPECIFICATIONS OF USED ITEMS

Table 1: Component specifications

Components name	specification
Arduino	Uno
Backup power supply	Small UPS
contactor	Ac powered
GSM module	GA06
enclosure	Plastic housing
Ultrasonic sensor	HC SR 04
Reed switch	Reed module
Circuit board	PCB
Soldering tin	1 m
Glue stick	small
Power supply	AC to DC 12V
Siren	120DB
buzzer	5v dc
LED	BLUE,RED

4.4 Summary

The circuit and block diagrams above show the actual result of our project, ensuring that the system functions as intended as we accomplish our project's goals.

According to the design, the implementation was simple and is operating effectively.

CHAPTER 5 :
CONCLUSION AND RECOMMENDATIONS

5.0 Introduction

This is last chapter of the project of my project research report which shows mainly the final conclusion about my project purpose and objectives not only that but also it contains the recommendation and other orientation to the one who will be interested to explorer more skills by referring to our project.

5.1Conclusion

Due to performance of my implementation related to the project research and the research problem I conclude that the objectives of my project is achieved well because the product I produce due to this project is helpful to the community.

5.2Recommendations

According to challenges I faced during the research and implementation of this project, also by referring to the benefit I gained during this project study as student of ULK poly technic I recommend firstly I recommend ULK poly technic I recommend to increase research facilities such as workshop with all possible tools and equipment which can be used by student to test the prototype of their proposed project this will increase the level of innovation skills.

For junior student I recommend them to read this project research so that they can use the skills and technology and then with combination of their thinking and innovative capacity they can improve or create great project which can change their welfare as well as the community.

5.3 Suggestions for further study

By using experience, I gained during this project study my suggestion to father study and research is that our college if possible can sign partnership with technology industries so that the student who study in ULK can have where their can receive practical skills in easy way via professional internship

This will increase technical and innovative skills for students who joined ULK polytechnic also more new student will be attracted.

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APPENDICES

1. SOURCE CODES

```
#include <SoftwareSerial.h>
SoftwareSerial mySerial(8,9); //A6 Tx & Rx is connected to Arduino #8 & #9
int buzz=2;
int vib_pin=3;
int swipin=4;
int swipinState=0;
int trigPin = 11; // Trigger
int echoPin = 12; // Echo
long duration, cm,inches;

void setup()
{
pinMode(trigPin, OUTPUT);
pinMode(echoPin, INPUT);
Serial.begin(115200);
mySerial.begin(115200);
Serial.println("Initializing...");
delay(1000);
mySerial.println("AT"); //Once the handshake test is successful, it will back to OK
updateSerial();
mySerial.println("AT+CSQ"); //Signal quality test, value range is 0-31 , 31 is the best
updateSerial();
mySerial.println("AT+CCID"); //Read SIM information to confirm whether the SIM is plugged
updateSerial();
```

```
mySerial.println("AT+CREG?"); //Check whether it has registered in the network
updateSerial();
pinMode(vib_pin,INPUT);
pinMode(buzz,OUTPUT);
pinMode(swipin,INPUT);

}
void loop()
{
digitalWrite(trigPin, LOW);
delayMicroseconds(5);
digitalWrite(trigPin, HIGH);
delayMicroseconds(10);
digitalWrite(trigPin, LOW);

// Read the signal from the sensor: a HIGH pulse whose
// duration is the time (in microseconds) from the sending
// of the ping to the reception of its echo off of an object.
pinMode(echoPin, INPUT);
duration = pulseIn(echoPin, HIGH);

// Convert the time into a distance
cm = (duration/2) / 29.1; // Divide by 29.1 or multiply by 0.0343
inches = (duration/2) / 74; // Divide by 74 or multiply by 0.0135

Serial.print("Distance: ");
```

```
Serial.print(inches);

Serial.print(" inches\t");

Serial.print(cm);

Serial.print("cm");

Serial.println();


delay(250);

int val;

val=digitalRead(vib_pin);

if(val==1)

{

digitalWrite(buzz,HIGH);

mySerial.println("AT"); //Once the handshake test is successful, i t will back to OK

updateSerial();

mySerial.println("ATD+250780952147"); // change ZZ with country code and xxxxxxxxxxx with phone number to dial

updateSerial();

delay(20000); // wait for 20 seconds...

mySerial.println("ATH"); //hang up

updateSerial();

digitalWrite(buzz,LOW);

}

swipinState=digitalRead(swipin);

if(swipinState==HIGH){

mySerial.println("AT"); //Once the handshake test is successful, i t will back to OK

updateSerial();

digitalWrite(buzz,HIGH);
```

```
mySerial.println("ATD+250780952147"); // change ZZ with country code and xxxxxxxxxxx with phone number to dial

updateSerial();

delay(2000); // wait for 20 seconds...

mySerial.println("ATH"); //hang up

updateSerial();

digitalWrite(buzz,LOW);

}


if(cm>10){

digitalWrite(buzz,HIGH);

mySerial.println("AT"); //Once the handshake test is successful, i t will back to OK

updateSerial();

mySerial.println("ATD+250780952147"); // change ZZ with country code and xxxxxxxxxxx with phone number to dial

updateSerial();

delay(10000); // wait for 20 seconds...

mySerial.println("ATH"); //hang up

updateSerial();

digitalWrite(buzz,LOW);

}

}
```

2. Cost estimation

The table below shows the required components to implement the prototype of our project result product and total cost.

Table 2: Cost estimation

Components name	**specification**	**Quantity required**	**Price of item in FRW**
Arduino	Uno	1	15,000 FRW
Backup power supply	Small UPS	1	40,000 FRW
contactor	Ac powered	1	20,000 FRW
GSM module	GA06	1	13,000 FRW
enclosure	Plastic housing	1	5,000 FRW
Ultrasonic sensor	HC SR 04	1	4,000 FRW
Reed switch	Reed module	1	2,000 FRW
Circuit board	PCB	1	1,000 FRW
Soldering tin	1 m	1	500 FRW
Glue stick	small	2	1,000 FRW
Power supply	AC to DC 12V	1	6,000 FRW
Siren	120DB	1	8,000 FRW
buzzer	5v dc	1	1000 FRW
LED	BLUE,RED	3	1,000 FRW
Permanent	small	1	2500 FRW
Total		**120,500 FRW**	