A PRELIMENERY REPORT ON

IOT BASED ANTI-THEFT BIKE

SUBMITTED TO THE SAVITRIBAI PHULE PUNE UNIVERSITY, PUNE

IN THE PARTIAL FULFILLMENT OF THE REQUIREMENTS

FOR THE AWARD OF THE DEGREE

OF

BACHELOR OF ENGINEERING (COMPUTER ENGINEERING)

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-2023

CERTIFICATE

This is to certify that the project report entitles

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ACKNOWLEDGEMENT

Every work is a source which requires support from many people and areas. It gives us proud privilege to complete the Project Stage I on “IOT BASED ANTI-THEFT BIKE" under the valuable guidance and encouragement of our guide Prof. Ratnakar Jagale

We are also extremely grateful to our respected H.O.D Dr. Dipak V. Patil, Prof. Ratnakar Jagale and Prof. Rahul Mandlik (Project Co-ordinators) for providing all facilities and every help for smooth progress of our Project. At last, we would like to thank all the staff members and our Colleagues who directly or indirectly supported us without which the Project work would not have been completed successfully.

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ABSTRACT

The objective of this Project is to design and to develop an electronic control and monitoring systems for motor Bike by integrating the android smartphone and microcontroller. The overall research passed through four phases: (1) needs analysis and identification, (2) designing the system, (3) implementation and development, and (4) testing the developed-system. The results of this research is an electronic system that able to communicate and integrate a microcontroller NodeMCU, Bluetooth devices and android smartphones for controlling and monitoring the DC motor of the two wheels bike. The general performance of the data communication between android smartphone and the developed electronic control will be effective and work properly. The android application can be installed in various brands of android smartphone and versions of the android operating system. The electric-bike can be switched on and off using an android smartphone which has been installed the developed application inside. The electric power condition of the batteries can be real time displayed in the android's screen.

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ABBREVIATION	ILLUSTRATION
MQTT	MQ telemetry transport
NodeMCU	Node Micro-controller unit
IDE	integrated development environment
IDV	Insured Declared Value

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1. Introduction

0.1. Motivation

Security is primary concern everywhere and for everyone. Every person wants his home, industry, valuable belongings such as bikes, cars to be secured. Would you ever consider leaving thousands of rupees worth of your personal belongings in the street without protection? Well, that is what you do every time you park your bike at the side of the road or anywhere else if you do not have a bike security system fitted to it. Most bikes/cars do not come with an effective protection system, and a determined thief is generally able to steal a car in a matter of seconds.

0.1. Problem Statement

Develop a IOT BASED ANTI-THEFT BIKE device to keep the bike secure and safe using a android application and a microcontroller.

2.0 Literature Survey

1. Survey no 1:

   Paper topic is Integrating Android Smartphone and Microcontroller System for Controlling and Monitoring The Two Wheels Electric-Bike. Concept -The objective of this research is to design and to develop an electronic control and monitoring systems for a Brushless DC (BLDC) motor that is employed to run a two wheels electric-bike by integrating the android smartphone and microcontroller via Bluetooth device. The overall research passed through four phases: (1) needs analysis and identification, (2) designing the system, (3) implementation and development, and (4) testing the developed-system.

   The results of this research is an electronic system that able to communicate and integrate a microcontroller Atmega 328, Bluetooth devices and android smartphones for controlling and monitoring the Brushless DC motor of the two wheels electric-bike.

   The general performance of the data communication between android smartphone and the developed electronic control system (via Bluetooth) will be effective and work properly within 0 upto 15 meters.

   The android application can be installed in various brands of android smartphone and versions of the android operating system. The electric-bike can be switched on and off using an android smartphone which has been installed the developed application inside. The electric power condition of the batteries can be real time displayed in the android's screen.

1. Survey no 2:

Paper topic is Design and Implementation of Biometric Based Smart Antitheft Bike Protection System, Concept – A lot of research are going on in the field of biometrics. The proposed idea in the paper concentrates on the application of biometric for two wheelers especially, motor bikes and scooters.
In our day to day life, a lot of motor bikes are missed and it is very difficult to find the location. This paper provides an effective solution in order to ensure more security and avoid unauthorized use of motorbikes.

In this project, a finger print based simple and efficient electric engine starter is proposed. Simple and effective hardware has been designed, implemented and tested with motorbikes.
Test results show that the developed system identify the correct person and allows the right person to start the bike

3.0 Software Requirements Specifications

3.1 Project Scope

An anti theft device for bikes protects it from theft, if anyone attempts to steal it. Some of them are manual anti theft devices for bikes while some are automatic. Usually, it is a compact device that you must attach to your bike to reduce the chances of theft.
Adding such a device on your bike is more of a necessity if you live in a theft-prone area or if you need to park the bike on the road open to the public.
When you buy a bike anti-theft device you are essentially decreasing the chances of bike theft. The insurance company will see it as an advantage as with the drop in the possibility of theft. Therefore the possibility of making an insurance claim against bike theft will also decrease.
A theft claim is considered as a major claim as the insurer needs to pay approximately the current market value of the bike.
Thus, most insurers offer a discount on bike insurance premiums if the bike is secured with an anti-theft device.

3.2 External Interface Requirements

1. Hardware Required
    - † NodeMCU

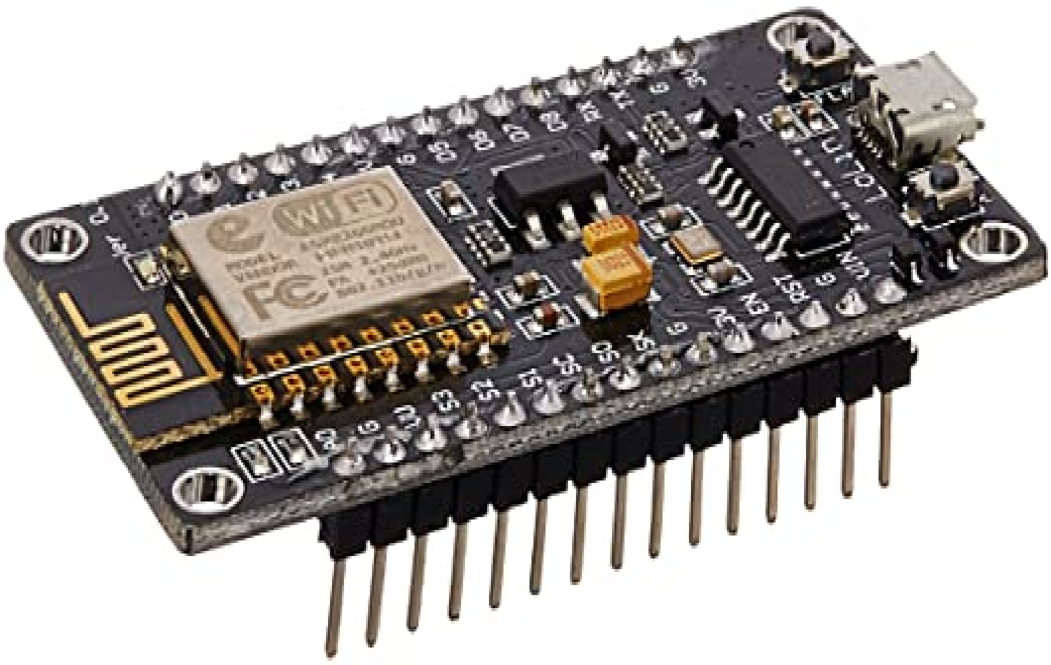

Fig 1.1

NodeMCU is an open source firmware for which open source prototyping board designs are available. The name "NodeMCU" combines "node" and "MCU" (micro-controller unit).[8] Strictly speaking, the term "NodeMCU" refers to the firmware rather than the associated development kits Both the firmware and prototyping board designs are open source.

The firmware uses the Lua scripting language. The firmware is based on the eLua project, and built on the Espressif Non-OS SDK for ESP8266.
It uses many open source projects, such as lua-cjson[9] and SPIFFS.[10] Due to resource constraints, users need to select the modules relevant for their project and build a firmware tailored to their needs. Support for the 32-bit ESP32 has also been implemented.

The prototyping hardware typically used is a circuit board functioning as a dual in-line package (DIP) which integrates a USB controller with a smaller surface-mounted board containing the MCU and antenna. The choice of the DIP format allows for easy prototyping on breadboards. The design was initially based on the ESP-12 module of the ESP8266, which is a Wi-Fi SoC integrated with a Tensilica Xtensa LX106 core, widely used in IoT applications (see related projects).

As Arduino.cc began developing new MCU boards based on non-AVR processors like the ARM/SAM MCU used in the Arduino Due, they needed to modify the Arduino IDE so it would be relatively easy to change the IDE to support alternate toolchains to allow Arduino C/C++ to be compiled for these new processors.

They did this with the introduction of the Board Manager and the SAM Core. A "core" is the collection of software components required by the Board Manager and the Arduino IDE to compile an Arduino C/C++ source file for the target MCU's machine language. Some ESP8266 enthusiasts developed an Arduino core for the ESP8266 WiFi SoC, popularly called the "ESP8266 Core for the Arduino IDE".[18]

This has become a leading software development platform for the various ESP8266-based modules and development boards, including NodeMCUs.

† Relay

A relay is an electrically operated switch. It consists of a set of input terminals for a single or multiple control signals, and a set of operating contact terminals. The switch may have any number of contacts in multiple contact forms, such as make contacts, break contacts, or combinations thereof.

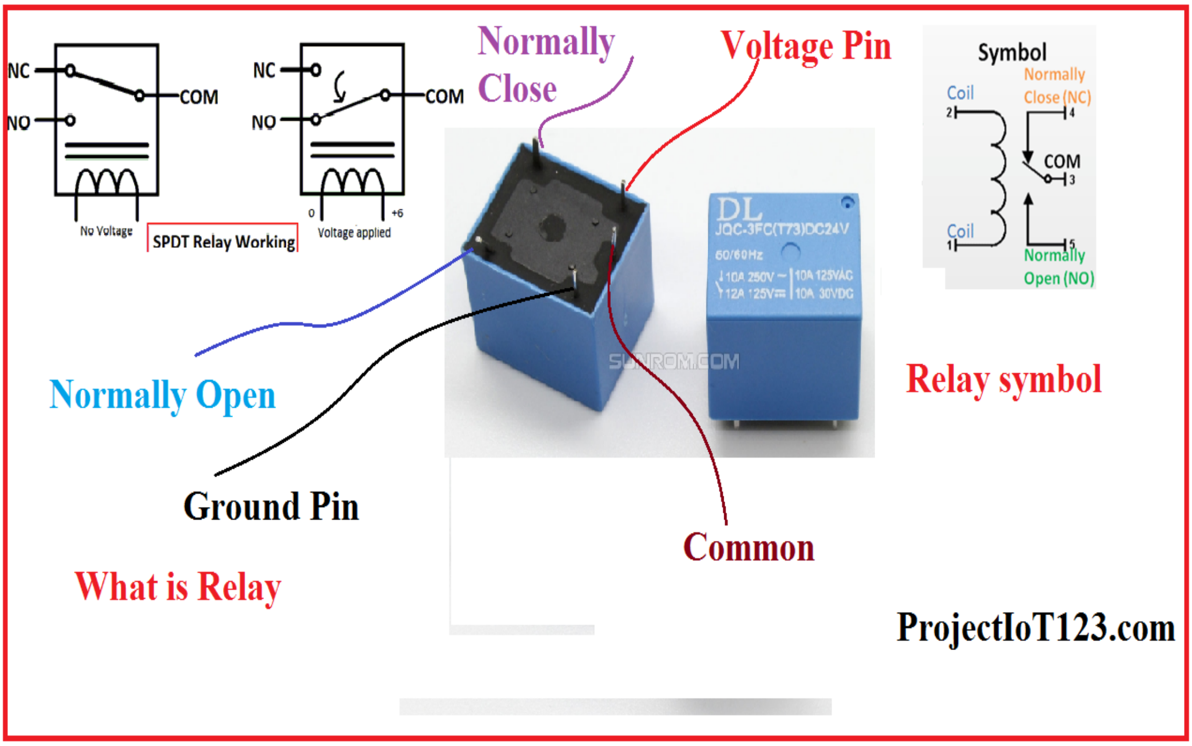

Fig 1.2

Relays are used where it is necessary to control a circuit by an independent low-power signal, or where several circuits must be controlled by one signal.

Relays were first used in long-distance telegraph circuits as signal repeaters: they refresh the signal coming in from one circuit by transmitting it on another circuit. Relays were used extensively in telephone exchanges and early computers to perform logical operations.

The traditional form of a relay uses an electromagnet to close or open the contacts, but relays using other operating principles have also been invented, such as in solid-state relays which use semiconductor properties for control without relying on moving parts. Relays with calibrated operating characteristics and sometimes multiple operating coils are used to protect electrical circuits from overload or faults; in modern electric power systems these functions are performed by digital instruments still called protective relays.

Latching relays require only a single pulse of control power to operate the switch persistently. Another pulse applied to a second set of control terminals, or a pulse with opposite polarity, resets the switch, while repeated pulses of the same kind have no effects. Magnetic latching relays are useful in applications when interrupted power should not affect the circuits that the relay is controlling.

A simple electromagnetic relay consists of a coil of wire wrapped around a soft iron core (a solenoid), an iron yoke which provides a low reluctance path for magnetic flux, a movable iron armature, and one or more sets of contacts (there are two contacts in the relay pictured). The armature is hinged to the yoke and mechanically linked to one or more sets of moving contacts.

The armature is held in place by a spring so that when the relay is de-energized there is an air gap in the magnetic circuit. In this condition, one of the two sets of contacts in the relay pictured is closed, and the other set is open. Other relays may have more or fewer sets of contacts depending on their function. The relay in the picture also has a wire connecting the armature to the yoke. This ensures continuity of the circuit between the moving contacts on the armature, and the circuit track on the printed circuit board

(PCB) via the yoke, which is soldered to the PCB.

When an electric current is passed through the coil it generates a magnetic field that activates the armature, and the consequent movement of the movable contact(s) either makes or breaks (depending upon construction) a connection with a fixed contact. If the set of contacts was closed when the relay was de-energized, then the movement opens the contacts and breaks the connection, and vice versa if the contacts were open. When the current to the coil is switched off, the armature is returned by a force, approximately half as strong as the magnetic force, to its relaxed position. Usually this force is provided by a spring, but gravity is also used commonly in industrial motor starters. Most relays are manufactured to operate quickly. In a low-voltage application this reduces noise; in a high voltage or current application it reduces arcing.

1. Software Requirements

♦ Java

Java is a popular programming language, created in 1995.
It is owned by Oracle, and more than 3 billion devices run Java.
It is used for

1. Mobile applications (specially Android apps)
2. Desktop applications
3. Web applications
4. Web servers and application servers
5. Games
6. Database connection

Why Use Java?

1. Java works on different platforms (Windows, Mac, Linux, Raspberry Pi, etc.)
2. It is one of the most popular programming language in the world
3. It has a large demand in the current job market
4. It is easy to learn and simple to use
5. It is open-source and free
6. It is secure, fast and powerful
7. It has a huge community support (tens of millions of developers)
8. Java is an object oriented language which gives a clear structure to programs and allows code to be reused, lowering development costs
9. As Java is close to C++ and C#, it makes it easy for programmers to switch to Java or vice versa

† Android Studio

Android Studio is the official integrated development environment (IDE) for Google's Android operating system, built on JetBrains' IntelliJ IDEA software and designed specifically for Android development. It is available for download on Windows, macOS and Linux based operating systems It is a replacement for the Eclipse Android
Development Tools (E-ADT) as the primary IDE for native Android application development.

Fig 1.3

Android Studio was announced on May 16, 2013, at the Google I/O conference. It was in early access preview stage starting from version 0.1 in May 2013, then entered beta stage starting from version 0.8 which was released in June 2014 The first stable build was released in December 2014, starting from version 1.0 At the end of 2015, Google dropped support for Eclipse ADT, making Android Studio the only officially supported IDE for Android development

On May 7, 2019, Kotlin replaced Java as Google's preferred language for Android app development. Java is still supported, as is C++.

Some highlights of Android Studio 4.1 include a new Database Inspector for querying your app's database, support for navigating projects that use Dagger or Hilt for dependency injection, and better support for on-device machine learning with support for TensorFlow Lite models in Android projects.

We've also made updates to Apply Changes to make deployment faster. Based on your feedback, we've made several changes to help game developers with a new native memory profiler and standalone profiling tools.

1. Database Requirements

♦ Firebase

Firebase is a Backend-as-a-Service (Baas). It provides developers with a variety of tools and services to help them develop quality apps, grow their user base, and earn profit. It is built on Google's infrastructure.
Firebase is categorized as a NoSQL database program, which stores data in JSON-like documents.

Fig 1.4

Key Features

1. Authentication

It supports authentication using passwords, phone numbers, Google, Facebook, Twitter, and more.

2. Realtime database

Data is synced across all clients in realtime and remains available even when an app goes offline.

3. Hosting

Firebase Hosting provides fast hosting for a web app; content is cached into content delivery networks worldwide.

4. Test lab

The application is tested on virtual and physical devices located in Google's data centers.

5. Notifications

Notifications can be sent with firebase with no additional coding.

4.0 System Design

4.1Flowchart

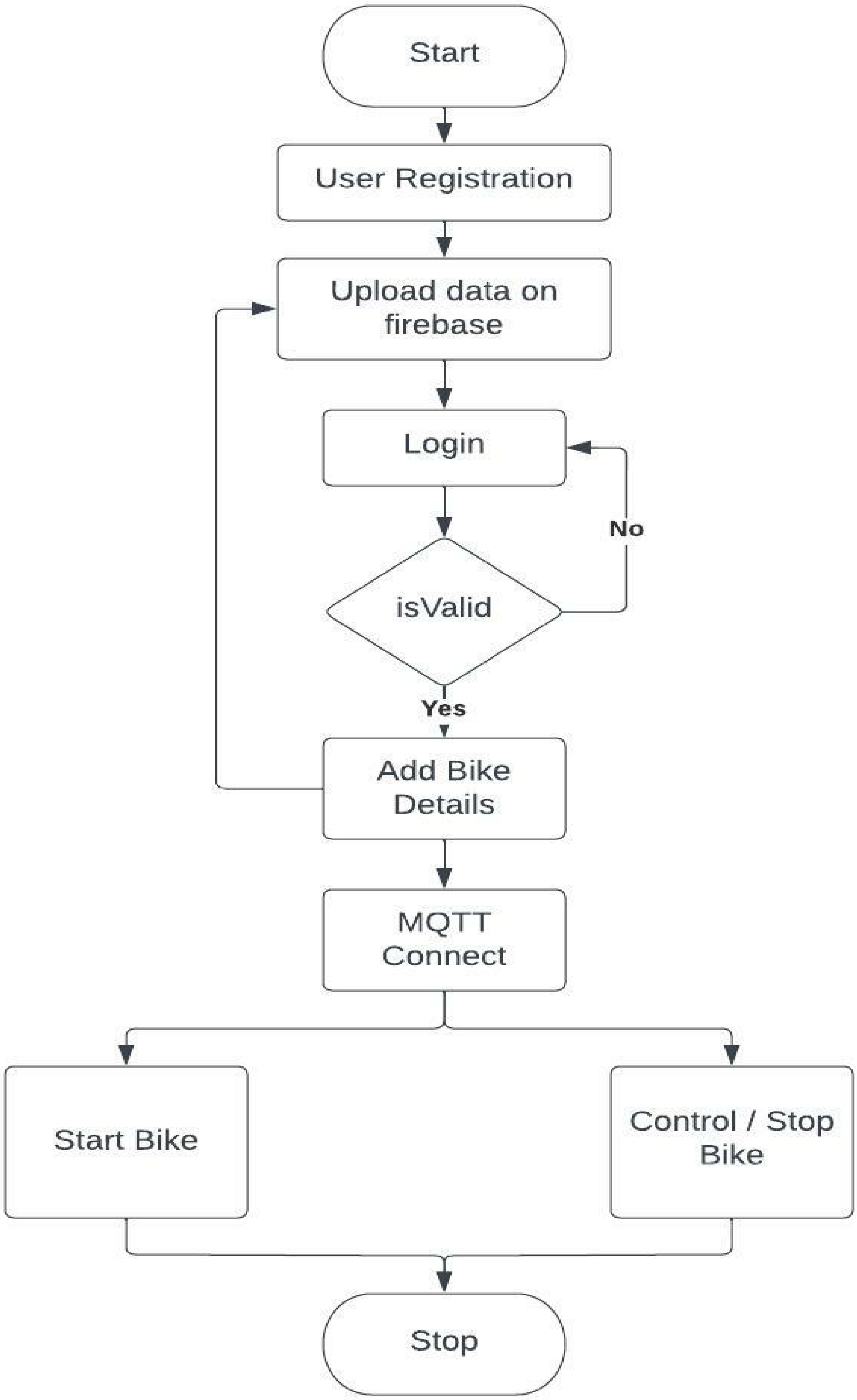

Fig 1.5

4.2 Class Diagram

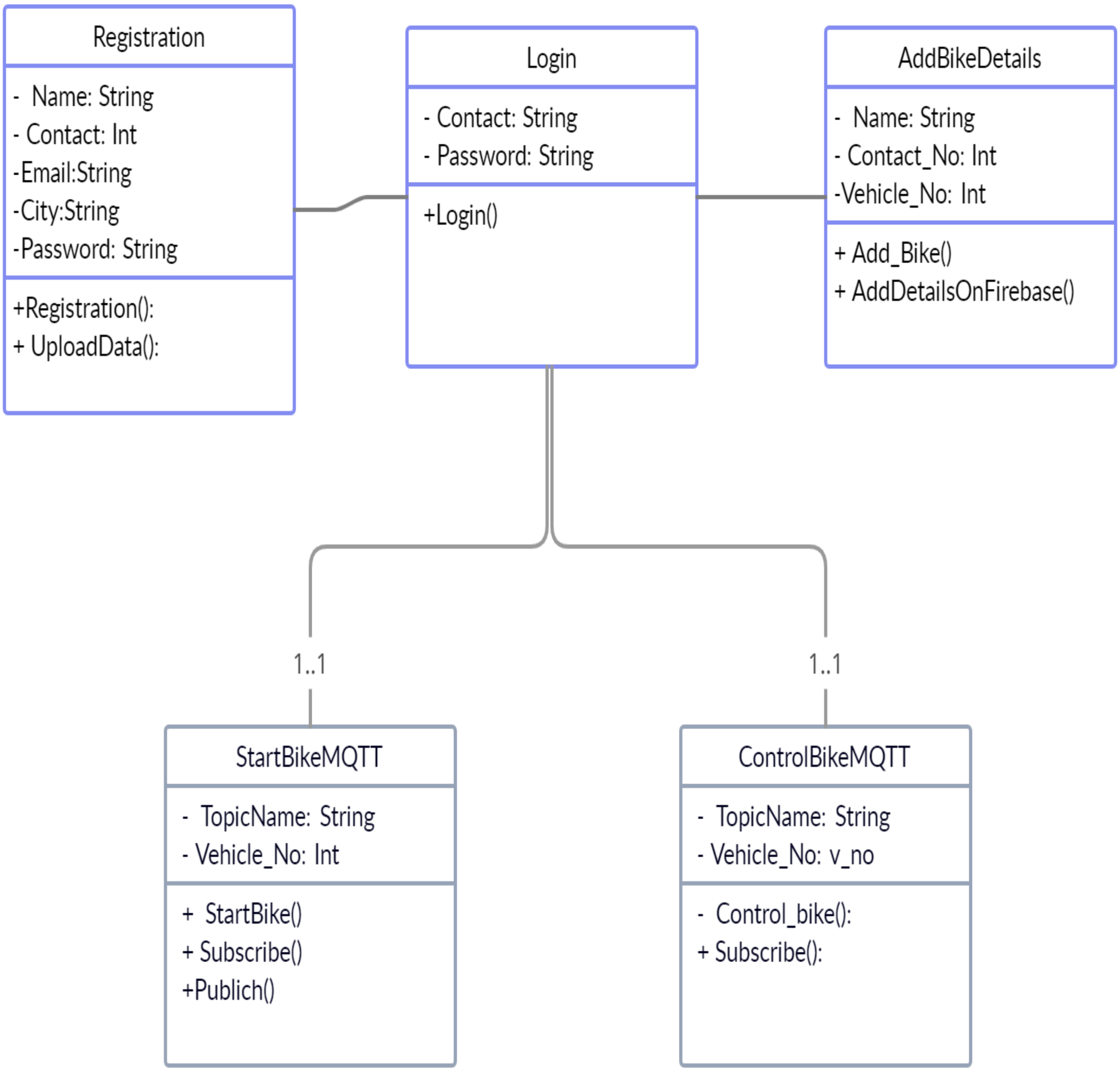

Fig 1.6

The purpose of class diagram is to model the static view of an application. Class diagrams are the only diagrams which can be directly mapped with object-oriented languages and thus widely used at the time of construction.

UML diagrams like activity diagram, sequence diagram can only give the sequence flow of the application, however class diagram is a bit different. It is the most popular UML diagram in the coder community.

4.3 Data Flow Diagram

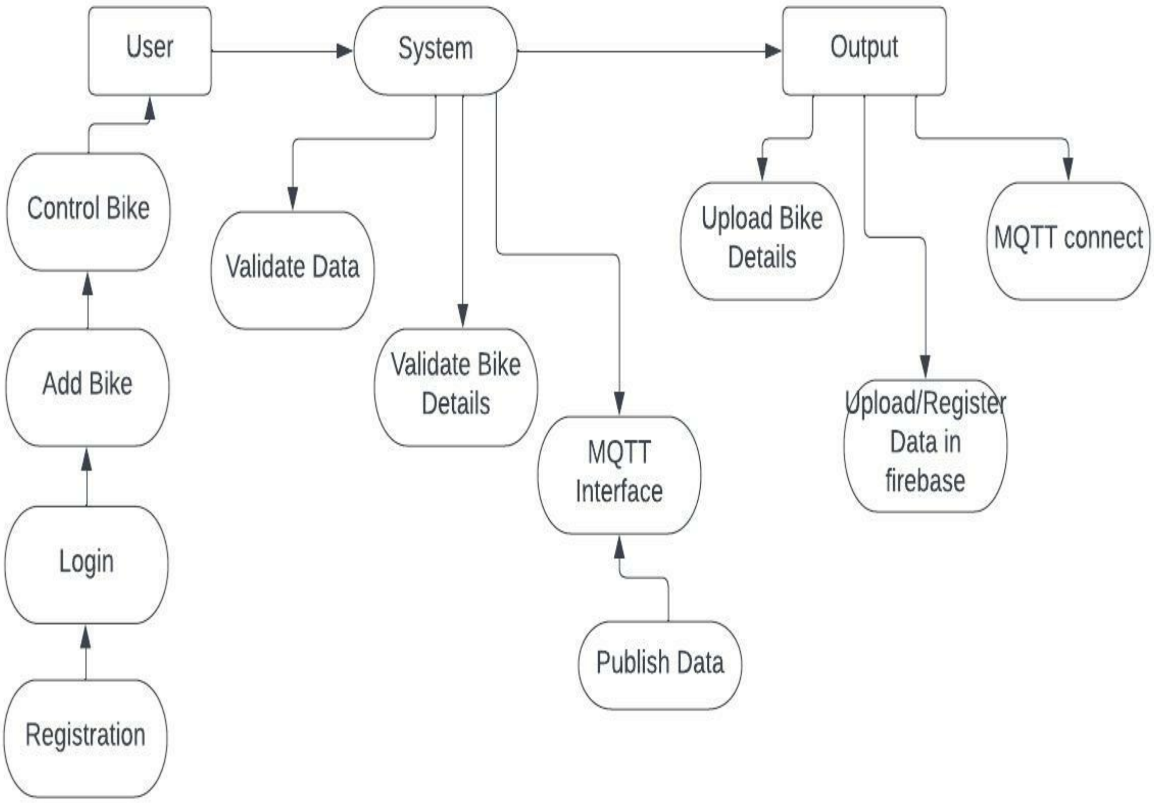

Fig 1.7

4.4 Block Diagram

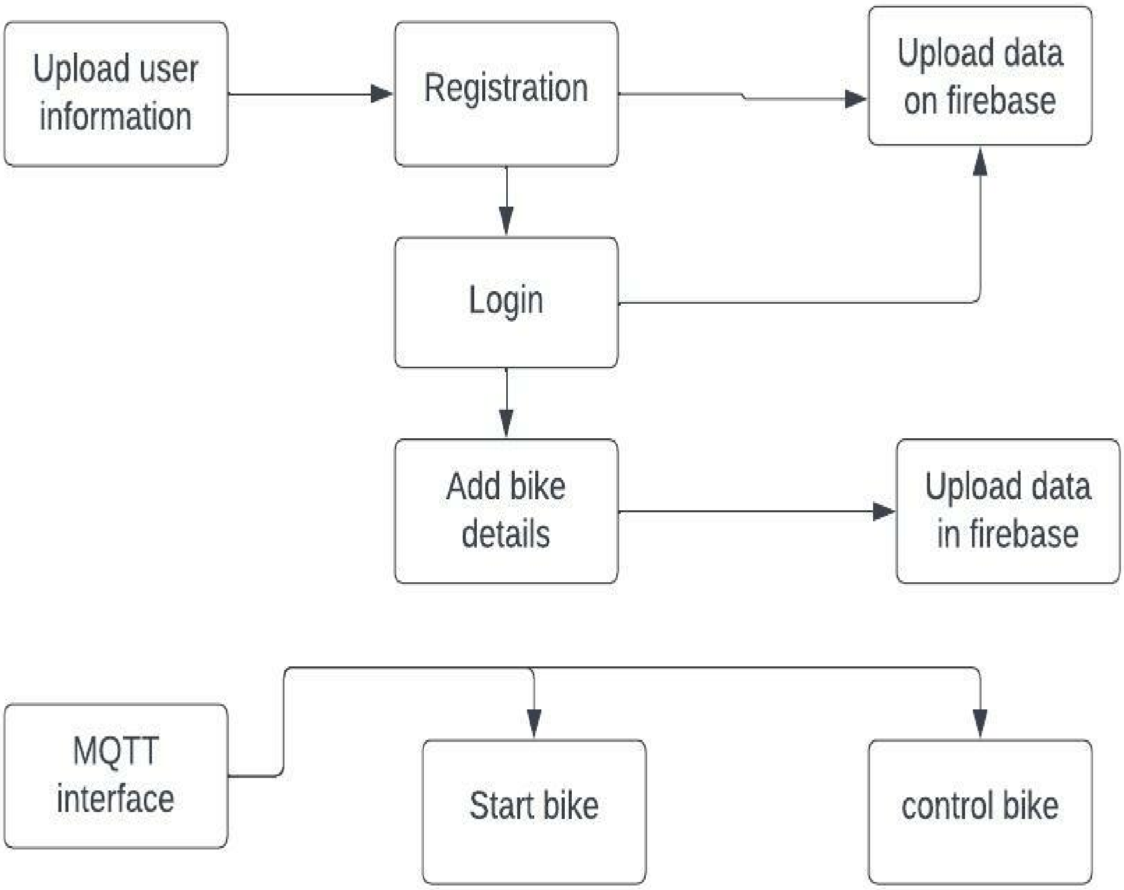

Fig 1.8

5.0 Project Plan

5.1 Project Estimate

5.1.1 Reconciled Estimates

Task 1: Research and Requirements Gathering

- Estimated Time: 2 weeks
- Actual Time: 3 weeks
- Variance: +1 week

The additional week was required to gather more comprehensive requirements from the stakeholders, which added to the scope of the project.
Task 2: Hardware Procurement and Assembly

- Estimated Time: 2 weeks
- Actual Time: 2 weeks
- Variance: 0 weeks

The hardware was procured and assembled within the estimated time without any issues.
Task 3: Software Development - NodeMCU Programming

- Estimated Time: 4 weeks
- Actual Time: 6 weeks
- Variance: +2 weeks

The development team experienced some unforeseen technical challenges during the NodeMCU programming phase, which led to additional time being required to complete this task.
Task 4: Software Development - Android App

- Estimated Time: 6 weeks
- Actual Time: 7 weeks
- Variance: +1 week

The Android app development required an additional week due to changes in the design of the app as per the feedback from the stakeholders.
Task 5: Integration and Testing

- Estimated Time: 2 weeks
- Actual Time: 3 weeks
- Variance: +1 week

The integration and testing phase took longer than expected due to the need for additional testing and debugging of the software.
Reconciled Project Estimation:

- Time: 20 weeks
- Variance: +5 weeks

5.1.2 Project Resources

1. Project Manager: The project manager is responsible for overseeing the project, managing project timelines, budgets, and deliverables. They are responsible for ensuring the project team is effectively working together, communicating with stakeholders, and meeting the project goals and objectives.
2. Hardware Engineer: The hardware engineer is responsible for selecting, sourcing, and assembling the hardware components required for the anti-theft bike system. They need to have experience in hardware design and selection, familiarity with the NodeMCU microcontroller, and working knowledge of electronic circuits.

3. Embedded Software Engineer: The embedded software engineer is responsible for developing the firmware for the NodeMCU microcontroller, programming the microcontroller with software algorithms, and interfacing the NodeMCU with the relay module. They need to have experience in embedded software development, proficiency in programming languages such as C++, and experience in IoT device development.

4. Mobile App Developer: The mobile app developer is responsible for developing the Android app that controls the anti-theft bike system. They need to have experience in Android app development, proficiency in programming languages such as Java or Kotlin, and experience with developing app interfaces.

5. User Experience (UX) Designer: The UX designer is responsible for designing the user interface (UI) and user experience (UX) for the mobile app. They need to have experience in user interface design, expertise in design software tools such as Sketch or Adobe XD, and knowledge of UX design principles.

6. Quality Assurance (QA) Engineer: The QA engineer is responsible for testing the anti-theft bike system to ensure it meets the project requirements, specifications, and performance standards. They need to have experience in software testing methodologies, knowledge of test management tools, and experience in creating test cases and test plans.

7. Technical Writer: The technical writer is responsible for documenting the development process, creating user manuals, and other technical documentation for the anti-theft bike system. They need to have experience in technical writing, knowledge of software development documentation standards, and expertise in writing user manuals.

8. Procurement Specialist: The procurement specialist is responsible for sourcing and acquiring the hardware and software resources required for the anti-theft bike system. They need to have experience in procurement and supply chain management, knowledge of vendor management, and experience in sourcing electronic components.

9. Marketing Specialist: The marketing specialist is responsible for creating a marketing plan, building brand awareness, and promoting the anti-theft bike system to the target audience. They need to have experience in marketing and advertising, knowledge of digital marketing techniques, and expertise in building marketing campaigns.

5.2 Risk Management

5.2.1 Risk Identification

1. Technical Risks:

- Failure of the hardware components such as NodeMCU or relay module during the testing or operational phase.
- Compatibility issues between the software and hardware components.
- Lack of expertise in embedded software development or hardware design, resulting in delays in project completion.
- Security vulnerabilities in the firmware or mobile app, leading to data breaches or system malfunctions.

1. Schedule Risks:

- Delays in the delivery of the hardware components or software libraries required for the project.

- Underestimation of the time required to complete the project, leading to missed deadlines.
- Unplanned changes or scope creep in the project, leading to schedule overruns.

1. Budget Risks:

- Unforeseen costs such as hardware replacement, licensing fees, or consultant fees.
- Budget constraints leading to the inability to procure the necessary hardware or software components.
- Inefficient resource allocation leading to budget overruns.

1. Resource Risks:

- Inadequate staffing or lack of expertise in critical roles such as hardware engineering or embedded software development.
- High employee turnover leading to loss of key project knowledge and experience.
- Inadequate training or documentation, leading to poor-quality work or delays in project completion.

1. Market Risks:

- Lack of demand for the anti-theft bike system, leading to low sales and revenue.
- Market competition leading to pricing pressures or inability to differentiate from competitors.
- Changes in the market landscape or regulatory environment, leading to disruption in the product's market position.

1. Operational Risks:

- System malfunctions leading to the inability to control the bike's ignition or potential safety hazards.
- Difficulty in integrating the anti-theft bike system with other existing bike systems.
- Inadequate user training or documentation, leading to improper usage or system malfunctions.

1. Legal and Compliance Risks:

- Failure to comply with legal regulations related to the use of IoT devices or personal data protection.
- Intellectual property infringement claims by competitors or third-party entities.
- Product liability claims due to system malfunctions or security breaches.

These are the potential risks associated with the project of developing an anti-theft bike system using NodeMCU and a relay, along with an Android app to control the ignition of the bike. By identifying these risks early in the project lifecycle, project managers and stakeholders can take necessary actions to mitigate and manage these risks, ensuring a successful project outcome.

5.2.2 Risk Analysis

1. Technical Risks:

- Likelihood: High
- Impact: High

- Mitigation:

    - Conduct thorough testing of hardware components such as NodeMCU and relay module during development and operational phase.
    - Conduct compatibility tests between the software and hardware components to ensure smooth system integration.
    - Hire experienced personnel or provide training to the team to avoid technical glitches.
    - Perform security testing and secure code development practices to avoid vulnerabilities.

1. Schedule Risks:

- Likelihood: Medium
- Impact: High
- Mitigation:

    - Conduct a feasibility study and create a realistic project schedule.
    - Monitor progress closely and maintain open communication with stakeholders.
    - Regularly review the project scope and adjust the timeline as necessary.
    - Be prepared to adapt to changes in the project timeline.

1. Budget Risks:

- Likelihood: Medium
- Impact: Medium
- Mitigation:

    - Create a detailed budget plan that includes all necessary expenses and account for unexpected expenses.
    - Monitor the project budget regularly to avoid overspending.
    - Consider alternative sources of funding or cost-saving measures if necessary.

1. Resource Risks:

- Likelihood: High
- Impact: Medium
- Mitigation:

    - Identify and hire skilled personnel with relevant experience.
    - Provide adequate training and development opportunities to ensure that team members have the necessary skills to complete the project.
    - Implement strategies to retain key personnel.
    - Create a knowledge management plan to preserve critical project information.

1. Market Risks:

- Likelihood: Medium
- Impact: High
- Mitigation:

  - Conduct a market analysis to assess demand and competition for the product.
  - Develop a marketing strategy that clearly communicates the product's benefits to potential customers.
  - Continuously monitor the market landscape for changes that may impact the product's position.
  - Consider product differentiation strategies to stand out from competitors.

1. Operational Risks:

- Likelihood: High
- Impact: High
- Mitigation:

  - Conduct rigorous testing to identify and address system malfunctions or safety hazards.
  - Ensure that the anti-theft bike system integrates smoothly with other existing bike systems.
  - Provide clear and concise user training and documentation.
  - Establish procedures for monitoring and addressing system malfunctions or user issues.

1. Legal and Compliance Risks:

- Likelihood: Medium
- Impact: High
- Mitigation:

  - Conduct thorough research on legal regulations related to the use of IoT devices and personal data protection.
  - Ensure that the product complies with all relevant regulations.
  - Implement secure coding and data protection practices to mitigate the risk of legal and compliance issues.
  - Obtain legal counsel to review and advise on potential legal risks.

These are the potential risks associated with the project of developing an anti-theft bike system using NodeMCU and a relay, along with an Android app to control the ignition of the bike. By conducting a thorough risk analysis, project managers and stakeholders can identify potential risks, assess their likelihood and impact, and implement mitigation strategies to minimize the risk of project failure.

5.3 Project Schedule

5.3.1 Project Task Set

1. Project Initiation Phase:

Duration: 4 weeks

- Define project scope and objectives
- Identify key stakeholders
- Conduct a feasibility study and risk analysis
- Develop a project plan and schedule
- Obtain necessary approvals and funding

1. Requirements Gathering Phase:

Duration: 2 weeks

- Define system requirements and features
- Gather user feedback and requirements
- Identify hardware and software components needed
- Develop a system architecture design

1. Development Phase:

Duration: 12 weeks

- Develop and test hardware components such as NodeMCU and relay module
- Develop and test software components such as Android app and server-side code
- Conduct integration testing to ensure smooth system integration
- Develop and execute a quality assurance plan

1. Deployment and Testing Phase:

Duration: 6 weeks

- Deploy the anti-theft bike system in a controlled environment
- Conduct system testing and debugging
- Conduct security testing and vulnerability assessment
- Develop and execute a user acceptance testing plan

1. Training and Support Phase:

Duration: 2 weeks

- Develop user manuals and training materials
- Conduct user training sessions
- Provide ongoing technical support and maintenance
- Develop a system upgrade and maintenance plan

1. Project Closure Phase:

Duration: 2 weeks

- Conduct a project post-mortem and document lessons learned
- Obtain feedback from stakeholders
- Obtain sign-off from stakeholders and close the project

These tasks cover the entire project lifecycle, from initiation to closure, and are crucial for the successful development and deployment of an anti-theft bike system using NodeMCU and a relay, along with an Android app to control the ignition of the bike. By breaking down the project into manageable tasks and phases, project managers and stakeholders can ensure that the project is completed on time, within budget, and meets the desired quality standards.

5.3.3 Timeline Chart

5.4 Team Organization

5.4.1 Team structure

1. Project Manager

- Oversees the entire project and ensures that it is completed on time, within budget, and meets quality standards
- Develops project plans and schedules
- Communicates project progress to stakeholders
- Coordinates the work of the other team members

1. Hardware Engineer

- Develops and tests the NodeMCU firmware
- Develops and tests the relay module and circuitry
- Develops and tests the battery management circuitry
- Develops and tests the power management circuitry
- Ensures that the hardware components meet the requirements and specifications of the project

1. Software Engineer

- Develops and tests the Android app UI and functionality
- Develops and tests the server-side code to communicate with NodeMCU
- Develops and tests the data storage and retrieval functionality
- Develops and tests the GPS tracking functionality
- Ensures that the software components meet the requirements and specifications of the project

1. Quality Assurance/Testing Engineer

- Conducts integration testing of the entire system

- Conducts hardware and software interface testing
- Tests the functionality of the entire system
- Ensures that the system meets quality standards and requirements.
- Reports any issues or defects to the project manager and team members for resolution.

5.4.2 Management reporting and communication

1. Regular Status Reports: The project manager should prepare regular status reports that provide updates on the project's progress, including milestones achieved, tasks completed, and any issues encountered. These reports should be distributed to the project team, stakeholders, and sponsors on a regular basis (e.g., weekly or bi-weekly).
2. Progress Meetings: The project manager should schedule progress meetings with the project team and stakeholders to discuss the project's progress, resolve issues, and review upcoming tasks. These meetings should be held at regular intervals (e.g., every two weeks) and should be attended by all key stakeholders.
3. Risk Management Meetings: The project manager should schedule risk management meetings to discuss and mitigate any identified risks. These meetings should be held as needed and should be attended by the project team and key stakeholders.
4. Change Management Meetings: The project manager should schedule change management meetings to discuss and approve any changes to the project plan, budget, or scope. These meetings should be held as needed and should be attended by the project team and key stakeholders.
5. Communication Plan: The project manager should develop a communication plan that outlines the project's communication strategy, including who will receive project updates, what information will be communicated, and how often. The communication plan should be distributed to the project team, stakeholders, and sponsors.
6. Issue Resolution: Any issues that arise during the project should be logged and tracked using a project management tool such as Jira or Trello. The project manager should ensure that all issues are resolved in a timely manner and that stakeholders are informed of any delays or changes to the project timeline.
7. Performance Reporting: The project manager should prepare performance reports that provide a summary of the project's performance against the project plan. These reports should include information on budget, schedule, and quality, and should be distributed to the project team, stakeholders, and sponsors at regular intervals (e.g., monthly or quarterly).

By implementing a robust management reporting and communication plan, the project manager can ensure that all stakeholders are informed of the project's progress, risks, and issues, and that the project is completed on time, within budget, and to the required quality standards.

6.0 Project Implementation

6.1 Overview of Project Modules

1. NodeMCU module: This module is responsible for communicating with the Android app over Wi-Fi and controlling the relay module. It reads the input from the Android app and sends it to the relay module to control the ignition of the bike. The NodeMCU module also sends notifications to the Android app if any unauthorized access is detected.

2. Relay module: This module is responsible for controlling the ignition of the bike. It receives input from the NodeMCU module and turns on or off the ignition based on the input received. The relay module also sends notifications to the NodeMCU module if any unauthorized access is detected.
3. Android app module: This module is responsible for providing a user interface for the bike owner to control the ignition of the bike. It sends input to the NodeMCU module over Wi-Fi to turn on or off the ignition of the bike. The Android app module also receives notifications from the NodeMCU module if any unauthorized access is detected.
4. Security module: This module is responsible for detecting any unauthorized access to the bike. It consists of a sensor that detects any movement of the bike and sends a signal to the NodeMCU module. The security module also sends notifications to the NodeMCU module and the Android app if any unauthorized access is detected.
5. Power module: This module is responsible for providing power to all the other modules in the system. It consists of a battery and a voltage regulator to ensure that the modules receive a stable power supply.
6. User management module: This module is responsible for managing user accounts and permissions. It allows the bike owner to add or remove authorized users from the system and assign different levels of access to each user.
7. Reporting module: This module is responsible for generating reports on the system's activity, such as the number of authorized and unauthorized access attempts, the time and date of access attempts, and any notifications sent to the NodeMCU module or the Android app.

By breaking down the system into these modules, the development team can work on each module separately and ensure that each module is functioning correctly before integrating it into the overall system. It also allows for easier debugging and maintenance of the system as each module can be tested and repaired separately if necessary.

6.2 Tools and Technologies Used

1. Arduino IDE: This is an open-source software development environment for writing, compiling, and uploading code to Arduino and compatible microcontroller boards such as the NodeMCU module.
2. NodeMCU Flasher: This tool can be used to flash the NodeMCU module with the firmware required to run the project. It is available for Windows, Mac, and Linux operating systems.
3. Android Studio: This is the official integrated development environment (IDE) for developing Android apps. It can be used to create the Android app that will communicate with the NodeMCU module over Wi-Fi.
4. Firebase: Firebase can be used to store and synchronize data such as user information, bike locations, and bike status information. The Android app can use Firebase APIs to interact with the database and retrieve data, as well as update the database with information such as bike location or status changes.
5. Smartphone: users to interact with the Android app and control the ignition of the bike. The app can be used to remotely start and stop the bike's engine, as well as track the bike's location and receive alerts in the event of a theft attempt.

6. Power supply: A reliable power supply is also crucial for the project, as both the NodeMCU device and the smartphone require power to operate. A battery or external power source can be used to power the NodeMCU device and ensure it remains connected to the internet and able to receive commands from the Android app. The smartphone also requires a reliable power supply to ensure it remains operational throughout the day, particularly if it is being used to track the bike's location or receive real-time updates.
7. NodeMCU: NodeMCU is an open-source firmware and development kit that is based on the ESP8266 Wi-Fi chip. It is used in this project as the IoT device that is installed on the bike and connected to the internet. The NodeMCU is responsible for receiving commands from the Android app and controlling the bike's ignition using a relay.
8. Relay: The relay is an electrical switch that can be controlled by the NodeMCU, allowing it to turn the bike's ignition on or off. It is used in this project as a key component of the anti-theft mechanism, allowing the user to remotely control the bike's ignition and prevent theft.
9. Java: Java is the programming language used to develop the Android app in this project. It is a popular language for developing Android apps and is used to create the user interface, implement the anti-theft features, and communicate with the NodeMCU device.
10. XML: XML is used in Android app development to create the user interface layout and design. It is a markup language used to describe the structure and appearance of the user interface elements in the app.

7.0 Software Testing

7.1 Type of Testing

1. Unit Testing: Unit testing involves testing individual units or components of the system, such as the NodeMCU device or the Android app. This is done to ensure that each component performs as expected and meets the requirements.
2. Integration Testing: Integration testing is used to test how different components of the system work together. In this project, integration testing is done to ensure that the NodeMCU device and the Android app communicate and function properly.
3. Functional Testing: Functional testing checks if the system functions as intended and meets the requirements. In this project, functional testing is done to ensure that the anti-theft mechanism works properly and that the Android app can control the bike's ignition.
4. Performance Testing: Performance testing is used to test the system's ability to handle a large number of users or requests. In this project, performance testing is done to ensure that the system can handle multiple requests from different users and respond in a timely manner.
5. User Acceptance Testing: User acceptance testing involves testing the system with end-users to ensure that it meets their requirements and expectations. In this project, user acceptance testing is done to ensure that the anti-theft mechanism is easy to use and effective in preventing bike theft.

In addition to these testing methods, it is also important to conduct security testing to ensure that the system is secure and cannot be easily hacked or compromised. This involves testing the system for vulnerabilities and implementing measures to prevent unauthorized access or manipulation of the system.
Overall, testing is an essential part of the development process for the anti-theft bike project using an IoT device and an Android app. It helps to ensure that the system functions as intended and meets the needs of the user, while also providing a secure and reliable solution for preventing bike theft.

7.2 Test cases & Test Results

Test Cases	Result (Pass/Fail)
Verify that the app displays the login screen when the user opens it for the first time.	Pass
Verify that the app displays the sign-up screen when the user clicks the "Sign Up" button.	Pass
Verify that the user is able to enter their email address and password when logging in or signing up.	Pass
Verify that the app shows an error message if the user enters an incorrect email or password combination.	Pass
Verify that the user is able to create an account by providing their name, email, password, and other required information.	Pass
Verify that the app shows an error message if the user enters an invalid email address.	Pass
Verify that the app shows an error message if the user leaves any required fields blank.	Pass
Verify that the app shows a logout button when the user is logged in.	Pass
Verify that the NodeMCU board is connected to the internet and can communicate with the Firebase server.	Pass
Test the connectivity of the NodeMCU board and the relay to ensure the relay can control the ignition.	Pass
Verify that the Android app can connect to the Firebase server and retrieve the relevant data.	Pass
Verify that the app can send the signal to the NodeMCU board to turn off the ignition when the bike is stolen.	Pass
Test the accuracy of the real-time notifications being sent to the app when the bike is stolen.	Pass
Test the accuracy of the real-time updates being sent to the Firebase server when the bike is moved.	Pass
Verify that the owner can turn off the ignition remotely from the app.	Pass
Test the accuracy of the real-time updates being sent to the Firebase server when the ignition is turned off remotely.	Pass

08 Results

8.1 Outcomes

8.2 Screen Shots(Code, User Interface, Outputs)

5.1 Advantages

When you buy a bike anti-theft device you are essentially decreasing the chances of bike theft. The insurance company will see it as an advantage as with the drop in the possibility of theft. Therefore the possibility of making an insurance claim against bike theft will also decrease. A theft claim is considered as a major claim as the insurer needs to pay approximately the current market value of the bike. Thus, most insurers offer a discount on bike insurance premiums if the bike is secured with an anti-theft device.

Theft cover in bike insurance

A bike insurance policy offers extensive coverage only if you choose the Comprehensive bike insurance policy. Along with bike damage, this type of insurance covers you for bike theft. Note that a bike theft insurance cover is not available with a basic Third-party Bike Insurance Plan as it does not cover the damages that your bike may suffer. Thus, if you are looking for an all-round coverage, you can select the comprehensive policy for your beloved bike.

Benefits of an anti theft device for bikes in India

Here is a list of benefits of installing an anti theft device for your bike in India.

Prevention of bike thefts attempts

The first and foremost purpose or benefit of getting an anti-theft device is to prevent your bike from getting stolen. So based on the type of anti-theft device you install, it will freeze the bike engine, sound an alarm, or send an alert on your mobile. All these are just ways to keep the possibility of bike theft at bay or help you take action even if a thief is successful in stealing the bike

Discounts on bike insurance premium

Apart from preventing theft, this is one of the primary reasons why people install an anti theft device on their bikes. The insurance company will appreciate the efforts you have made to protect the bike with the security system and might reward you with a discount on the bike insurance premium.

Easy claim settlement

In an unfortunate case where your bike gets stolen in spite of having a bike security device, the insurance company will settle the claim without much hassle. This is because you have taken measures to safeguard the bike but it still was subjected to theft. So, apart from a discount on bike insurance premium, your theft claim will be settled faster.

Avoid a financial loss

A stolen asset equals financial loss. You lose the money you have invested in buying a bike as it is no longer in your possession. Even if you raise a claim and receive the settlement amount, you will not get the amount you paid to buy the bike in the first place. This is because a lot of factors are involved in calculating the claim amount when it comes to bike theft. For example, depreciation. This is the reduced value of the bike due to usage.

Say you use the bike for two years before it got stolen. Here two years worth of depreciation will be considered to calculate the claim amount. This is also the amount you set while buying the insurance policy. It is called the Insured Declared Value (IDV) of the bike. In simpler words, you don't get the full value of the bike if it gets stolen.

Prevents the hassle you go through after bike theft
Once your bike gets stolen, you need to go through the hassle of filing an FIR and collecting the required documents from the police station to prove theft and make a claim against your two wheeler insurance policy. This entire process can take months to finish.

You also need to regularly follow up with the authorities to understand the status of your request. With an anti theft device on the bike the chances of you going through this hassle are reduced exponentially.

5.2 Applications

- Bikes
- Cars
- Personal AI working machine robots
- Any Machine that requires ignition.

6.0 Conclusion

The control system for motor to run the two wheels bike has been successfully designed and developed. The main components are microcontroller NodeMCU module, and Android smartphone with its application.

The electronic control system based on NodeMCU (for the motor) with embedded module and the Android smartphone can be integrated and performing a new system that has the performance as follows: data communication between the smartphone and the electronic control system via android can be run. Android application can be used to turn on and turn off the power of the electric-bike, and displays the battery voltage level in real time.

Android application program can be installed in various brands of smartphones and various versions of the android operating system.

7.0 References

[1]. “Design and Implementation of Biometric Based Smart Antitheft Bike Protection System" by K.S. Tamil selvan, G. Murugesan, S. Sasikumar.
[2]. “Integrating Android Smartphone and Microcontroller System for Controlling and Monitoring The Two Wheels Electric-Bike" by Rustam Asnawi1 , Ariadie Chandra Nugraha2 , Andik Asmara3 , I Gede Dangin.