



# Proposal Defence FYP I

## Easy Parcel: IoT-Based Parcel Storage System for University Villages

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**03**    **Introduction**

**10**    **Literature Review**

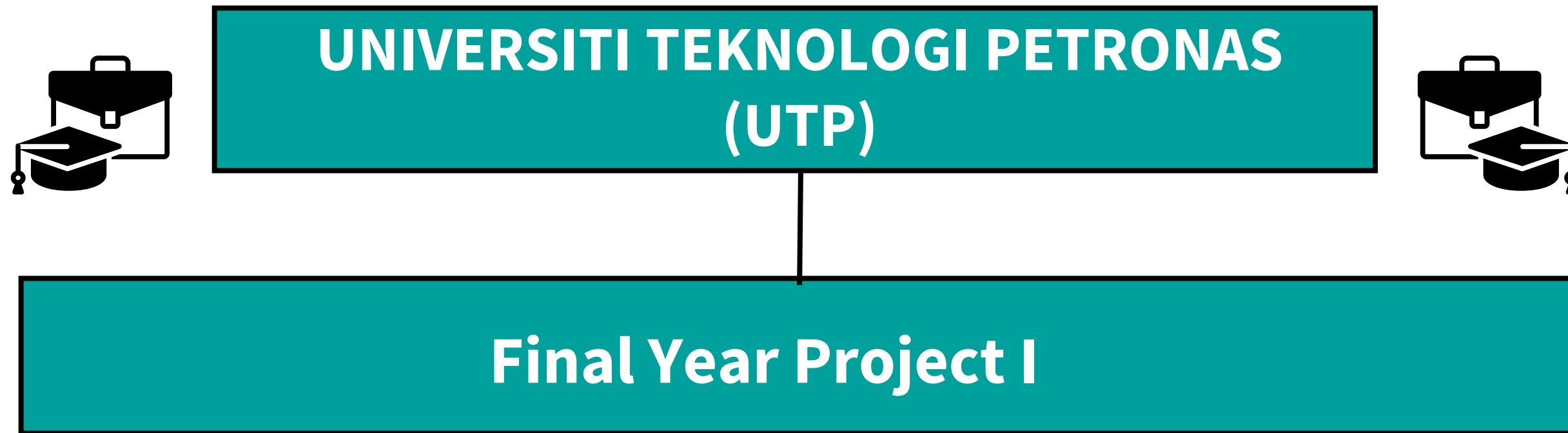
**14**    **Methodology**

**21**    **Conclusion & Future Works**



# INTRODUCTION





## OBJECTIVES

The purpose of the project is to develop a framework, which will enhance students' skills in the process of applying knowledge, expanding thoughts, solving problems independently and presenting findings through minimum guidance and supervision.

## WHAT?

**Network of interconnected devices that collect, send, and receive data through the internet to automate and improve processes.**

## APPLICATION

- Smart Homes
- Healthcare
- Transportation
- Agriculture
- Logistics and Delivery



## Internet of Things (IoT)

## TECHNOLOGIES USED

- Sensors & Actuators
- Microcontrollers (e.g., ESP32, Raspberry Pi)
- Cloud Platforms & Mobile Apps

## IMPORTANCE

- Enables automation and real-time monitoring
- Increases efficiency and reduces manual work

## FEATURES

- Remote access & control
- Data collection & analytics
- Integration with mobile apps

# BACKGROUND OF STUDY

## 1 Malaysia E-commerce Growth

- E-commerce in Malaysia has seen remarkable growth in recent years
- Malaysia is now one of Southeast Asia's leading digital markets
- E-commerce users projected to increase by over 75% reaching expected 18.81 million users by 2029

## 2 University Students Role in E-commerce

- University students make up a large and growing portion of online shoppers
- Known for high digital literacy and frequent internet and mobile usage
- Prefer e-commerce for its convenience, affordability, and variety

### SUMMARY

- ParcelHub was introduced to manage the increasing volume of parcels received by university students.
- The system supports the growing trend of online shopping among students.
- ParcelHub ensures students receive their parcels safely and at a time that suits their schedule.
- It aims to streamline the delivery process and reduce issues like lost or mishandled parcels.





**While the ParcelHub aims to simplify parcel collection, it still has notable flaws that impact student convenience.**

**One centralized location (ParcelHub), far from most student residences**

**Long queues during peak hours**

**Inconvenient for students without transport**

**Creates parking problems for those who drive**

**Students must pay additional charges to collect parcels**



**To design and develop an IoT-based smart locker system for student villages to store small parcels securely**



**To build a mobile application for both students and couriers to manage locker access, track deliveries, and receive parcel notifications.**

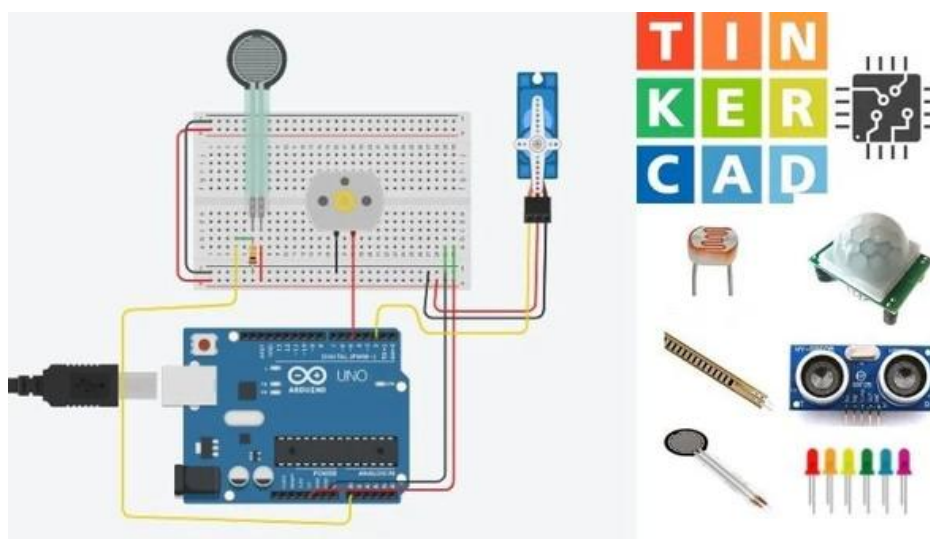


**To implement a random password lock system and barcode scanning for secure identification of parcel senders (couriers) and receivers (students).**



# SCOPE OF STUDY

- Build a smart locker prototype using **Arduino, sensors, and locks.**
- Simulate circuit design using **Tinkercad.**
- Connect hardware to **Firestore** for real-time status and access logging.



- Develop a mobile app using **Flutter** for students and couriers to access lockers, track parcels, and receive notifications.
- Data will be managed using **Firestore**.



- Implement OTP-based access using **Firestore Authentication.**
- Integrate **barcode scanning** to log parcel sender and receiver details, with records stored in the cloud.



# LITERATURE REVIEW





## LITERATURE REVIEW – RESEARCH STUDY

Study	Technology / Focus	Strengths	Weaknesses	Limitations
Refaningati et al. (2020)	City-level smart locker logistics (Indonesia)	<ul style="list-style-type: none"> <li>Improved delivery efficiency (30%)</li> <li>Traffic reduction</li> </ul>	<ul style="list-style-type: none"> <li>No user-facing tech</li> <li>No tracking system</li> </ul>	Not designed for campus use or user notification features
Wang et al. (2024)	E-commerce adoption in Malaysia	<ul style="list-style-type: none"> <li>Insight into student demand and mobile behavior</li> </ul>	<ul style="list-style-type: none"> <li>No proposed system</li> <li>Theoretical only</li> </ul>	No technological implementation or real-world delivery model
Naik et al. (2020)	Secure smart locker with face recognition	<ul style="list-style-type: none"> <li>High security (ECC, camera alerts)</li> <li>IoT-based access</li> </ul>	<ul style="list-style-type: none"> <li>Over-secured for public/shared use</li> <li>No mobile or student interaction</li> </ul>	Not scalable or practical for student village environments
Poliku Parcel System (2024)	Web-based parcel management for academia	<ul style="list-style-type: none"> <li>Academic-focused design</li> <li>Staff/Admin dashboards</li> <li>Iterative Agile UX</li> </ul>	<ul style="list-style-type: none"> <li>Web-only (no mobile app)</li> <li>No smart locker hardware</li> </ul>	Does not support physical locker integration or secure parcel retrieval
UUM UPC (Zainuddin et al., 2021)	Service quality evaluation at UUM's UPC	<ul style="list-style-type: none"> <li>SERVQUAL-based improvements</li> <li>Trusted, accessible hub</li> </ul>	<ul style="list-style-type: none"> <li>Long queues</li> <li>Poor pickup system</li> <li>Charges &amp; inconsistent SOP</li> </ul>	Manual collection, no automation or mobile-based access



## RESEARCH GAPS

### Student-specific design

1

Most systems aren't tailored for students in residential campus settings with limited mobility.

### Lack of integrated mobile control

2

Systems like Poliku and UPC use web-based tools but don't integrate with mobile apps or IoT hardware.

### Access & security balance

3

Most systems fail to balance security with usability, making them either too complex for shared campus environments or too basic to ensure parcel safety.

### Courier-side support

4

Existing solutions rarely include features that support courier-side access, such as barcode scanning or OTP verification for secure parcel drop-offs.

### Affordability & Scalability

5

Commercial systems may be costly and hard to scale or adapt in smaller campus communities.



## Solution of The Research Gaps – Easy Parcel

### Student-specific design

1

**Easy Parcel is designed specifically for student residential villages, where students often lack personal transport and need accessible, on-campus parcel services**

### Lack of integrated mobile control

2

**The system includes a dedicated mobile app, allowing students to receive real-time notifications, track parcels, and open lockers using OTPs**

### Access & security balance

3

**Instead of complex biometric systems, Easy Parcel uses practical OTP, offering secure access without overcomplicating the user experience**

### Courier-side support

4

**Couriers can deliver parcels into specific lockers, reducing delivery errors and enabling secure, contactless drop-offs**

### Affordability & Scalability

5

**The system is prototyped using Arduino for proof of concept, but designed to scale using affordable, off-the-shelf IoT components for real-world deployment in campus**

# METHODOLOGY





## SMART LOCKER – HARDWARE

### Design & Simulation Phase

- Use Arduino Uno R3 as the main microcontroller.
- Design and simulate the electronic circuit using Tinkercad.
- Simulate component connections, logic flow, and system behavior in a cost-effective and safe environment.

### Verification & Confirmation

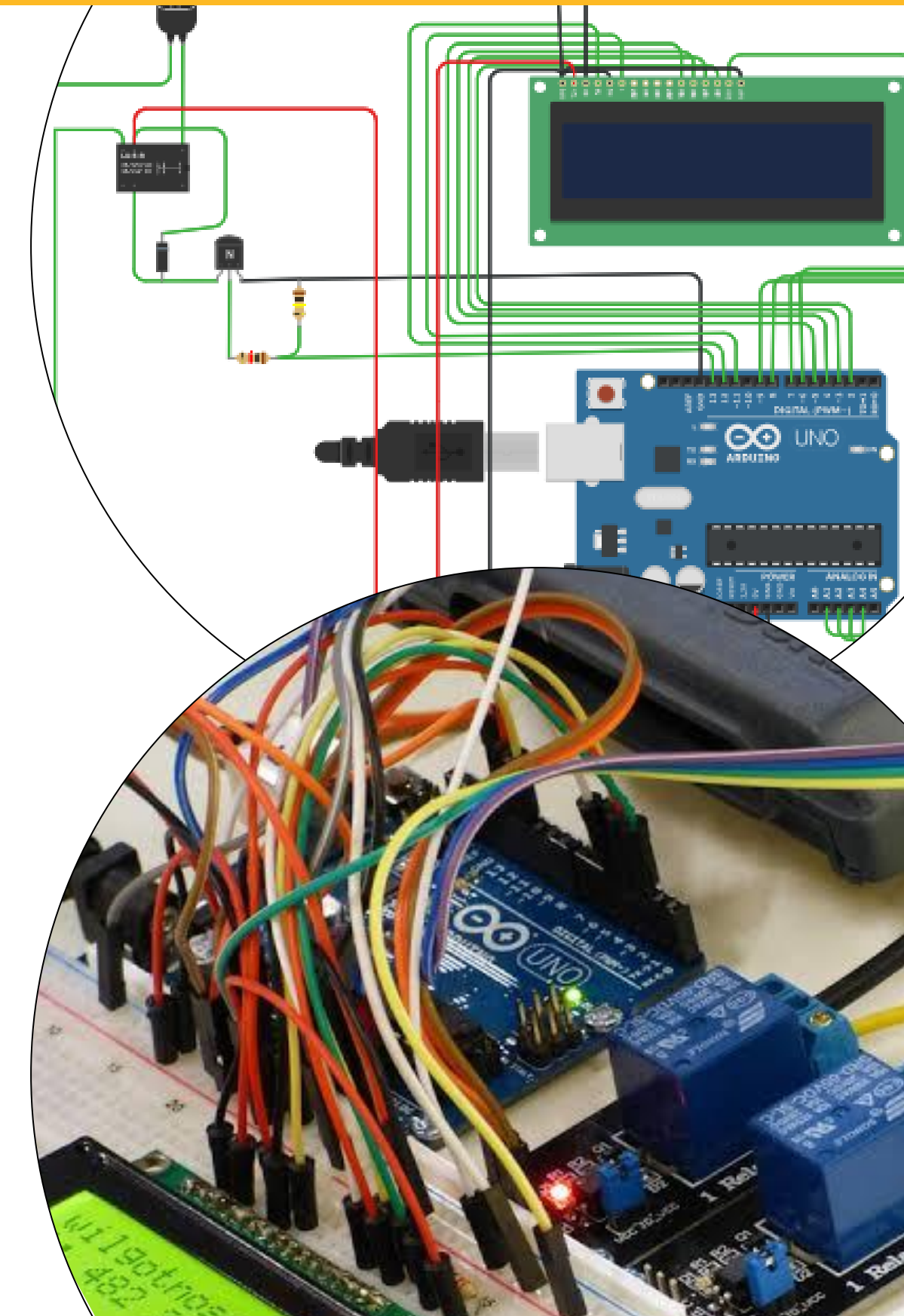
- Confirm the design through Tinkercad simulation to ensure it works as intended.

### Physical Assembly Phase

- Assemble the hardware using real components based on the validated simulation design.

### Implementation & Testing

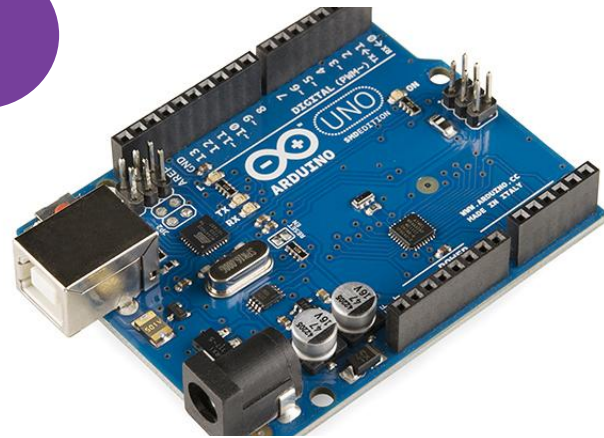
- Implement the system step-by-step to ensure a smooth transition from design to prototype. Aim to minimize errors and rework during development.





## HARDWARE COMPONENTS

**1** **Arduino Uno R3**



Main microcontroller for controlling inputs and outputs.

**2** **Servo Motor**



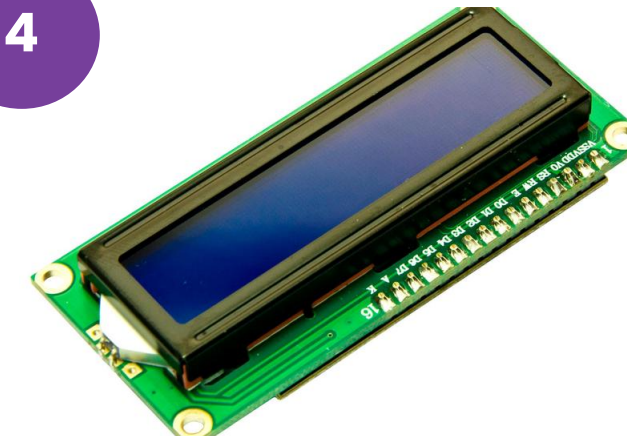
To open and close the locker door electronically.

**3** **Keypad**



To allow manual entry of OTP or password.

**4** **LCD**



To display status messages or OTP confirmations.

**5** **Locker**



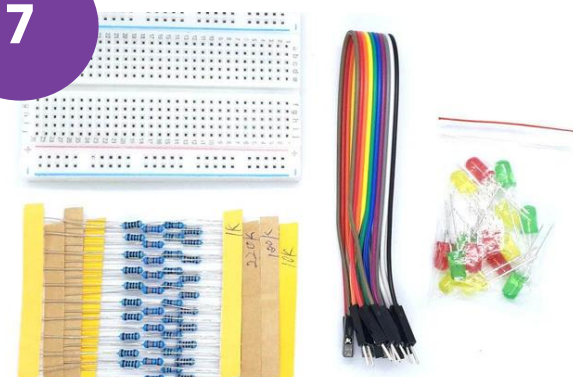
To house the electronics and simulate the parcel storage compartment.

**6** **Barcode Scanner**



To scan courier and parcel information.

**7** **Breadboard, Wires, Capacitor and LED**



For circuit connections and prototyping.

**8** **Buzzer**



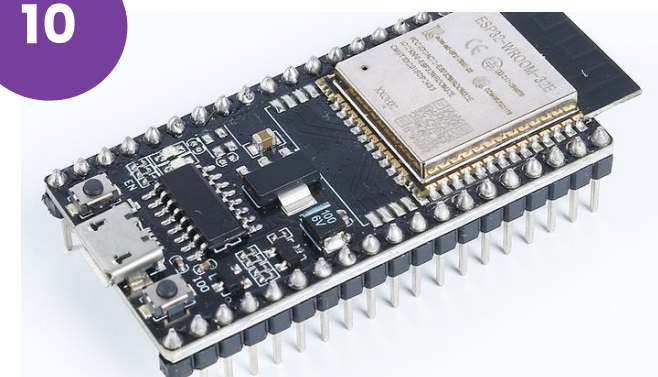
To provide audible feedback (e.g., when access is granted or denied).

**9** **OV7670**



(optional) For capturing images/videos during locker access.

**10** **ESP32**



(optional) To enable wireless communication with Firebase if direct integration is needed.



## MOBILE APPLICATION – SOFTWARE

**The mobile application will be developed using Flutter, a cross-platform framework by Google that allows building Android and iOS apps from a single codebase. Flutter is chosen for its fast development, beautiful UI capabilities, and seamless integration with Firebase.**



### Development Process

#### UI Design

- Create wireframes and user flow diagrams to outline the structure and navigation of the app.

#### App Development

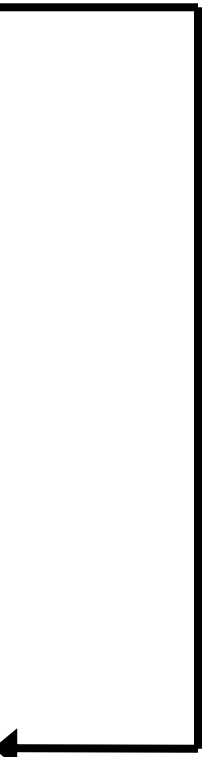
- Build the app using Dart and Flutter's widget system for smooth, responsive interfaces.

#### Firebase Integration

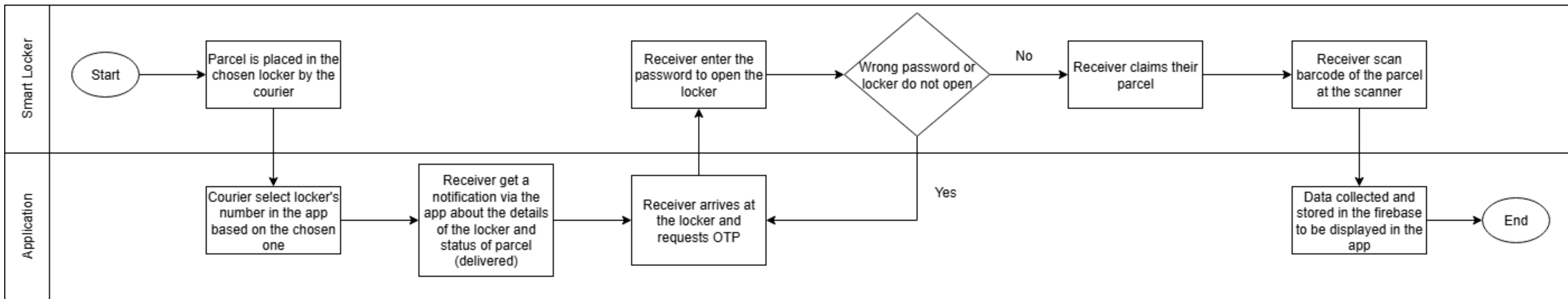
- Use Firebase Authentication for OTP-based login.
- Use Firestore to manage parcel and locker data.
- Enable Firebase Cloud Messaging (FCM) for push notifications.

#### Testing

- Perform functional and usability testing to ensure smooth performance across platforms.



## SYSTEM ARCHITECTURE



[illegible]

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## EXPECTED OUTCOME

### **Functional Smart Locker Prototype**

**A working locker system using Arduino with servo lock, keypad, and barcode scanner to simulate secure parcel storage and retrieval.**

### **Mobile Application for Students and Couriers**

**Flutter-based app allowing users to receive parcel notifications, track deliveries, and access lockers via OTP or barcode.**

### **Secure Parcel Access System**

**Implementation of OTP and barcode scanning for authenticated courier drop-off and student pick-up.**

### **Improved Parcel Handling Experience for Students**

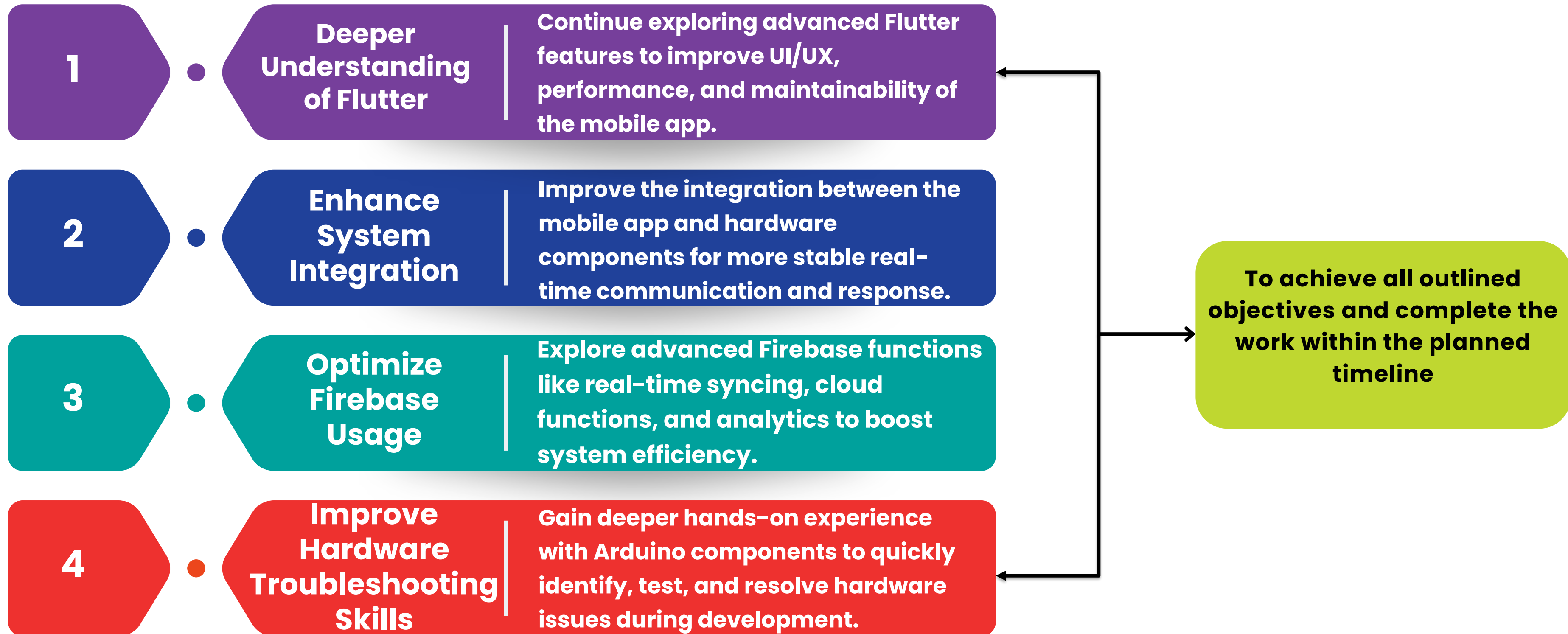
**Faster, more convenient, and more secure alternative to centralized collection points like ParcelHub.**

# CONCLUSION & FUTURE WORKS





**This project aims to improve the parcel collection experience for students by introducing a smart, secure, and accessible locker system within residential villages. By integrating IoT hardware with a mobile app, it offers a more convenient and efficient solution compared to the current centralized ParcelHub system.**





THANK YOU

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