Knockly
Our Smart Door System

Group 8

Introduction

Market Needs:

- 16.1 million people in the UK have a disability (DWP, 2024)
- Many face trouble with answering the door and accessing their own home.

The Idea:

- Smart Doorbell – for easy communication and remote access.
- Automated Door System – designed to allow easy entry and exit, integrated with the doorbell.
- Accessible User Interface – providing control to the homeowner with an accessible application.

Unique Selling Points:

- Addresses an overlooked segment of the smart home technology market.
- Empower individuals with greater independence within their own home.
- Designed primarily to aid those with mobility challenges.

Context

Problems in the Market:

- Smart home technology is growing in popularity, but accessibility remains an afterthought.
- Existing smart doorbell systems lack essential accessibility features, like automated door opening / closing.
- Meanwhile, disabled access systems lack smart technology and do not integrate with current smart home systems.

Challenges for Disabled People:

- Hearing the doorbell, responding to visitors or deliveries, and entering/exiting can be difficult.
- The lack of accessible solutions impacts independence for some.
- The only current options are a compromise.

Context

A smart doorbell system, lacking accessibility features, no integration with the door.

A typical disabled access system, no smart technology, not applicable for a home, designed for commercial use.

Problem Definition

The Current Limitations:

- Conventional smart doorbell systems are not designed with accessibility features in mind and still require movement to answer.
- This is not a solution for many people, for instance those who struggle with mobility or hearing.
- No current option for the affected individuals.

Our Solution:

- Smart doorbell with automated door / disabled access door integration.
- Designed specifically for accessibility, offering an easy-to-use interface and entry / exit system.
- Facial recognition and an intuitive mobile application allow easy operation of the system.

System Overview

- **Facial Recognition:** Smart doorbell identifies users via AI through camera sensors and allows entry to registered faces
- **Mobile App:**
  - Displays live feed of the doorbell and allows owners to admit/deny users entry remotely if unfamiliar face is detected
  - Manages and stores the smart doorbell's Face IDs and User IDs
- **Backup Access:** Manual overrides via app, doorbell password or a manual doorbell button
- **Connected to motor:** Product communicates to a motor which opens the door.

Functional Requirements

1. The doorbell must have facial recognition for access control	2. The mobile app should allow the owner to verify users if the doorbell triggers an alert
3. A backup failsafe must allow owners access during failures.	4. The app should support multiple user configurations per doorbell
5. All the relevant systems must be connected to each other and work with the mobile app	6. The doorbell should distinguish humans from non-humans
7. The app must have emergency override	8. The app should work on multiple devices for any user and manage users that can access the home

Non-functional Requirements

1. Facial recognition runs in real time on the doorbell and the app	2. Motion sensors must be sensitive enough to avoid false alerts
3. The doorbell must adequately function in different conditions and scenarios like low lighting, crowded entry etc.	4. Facial recognition should activate only when a user remains in a set position for a certain duration.
5. The app must be accessible for users with various disabilities	6. Both the doorbell and mobile app adhere to data privacy and data protection standards - GDPR

Hypothetical Real-world Integration

Current Prototype:

- Uses servo + cardboard/foam model to demonstrate concept due to equipment constraints.

Hypothetical Implementation:

  - Retrofit kit concept: High-torque motor / linear-actuator, electric strike plate, smart deadbolt integration, control-module (wired – relay-based (12V/24V power-supply), wireless (WiFi/Bluetooth)
  - Smart door compatibility: Potential API connections (Samsung, Bosch etc.)
  - Safety & Backup: Manual Overrides (keys, keypads), obstruction sensors.

Why it works?

- Non-intrusive, flexible for various doors (universal mounting bracket to support various door types (hinged, sliding, commercial), scalable (DIY or pro-install)

Testing Plan

Automated Testing Advantages

- Reliability
- Efficiency
- Manageability

Automated Testing	Manual Testing
PyTest	Response Time
Paho-MQTT	Reliability
JUnit	Facial Recognition Accuracy
Espresso	System Accessibility

Project Management

- **Multiple Components, One Iterative Process**

Break down the doorbell camera, motion sensors, facial recognition, and app integration into smaller sprints for continuous testing.

- **Real-World Data & Accessibility Feedback**

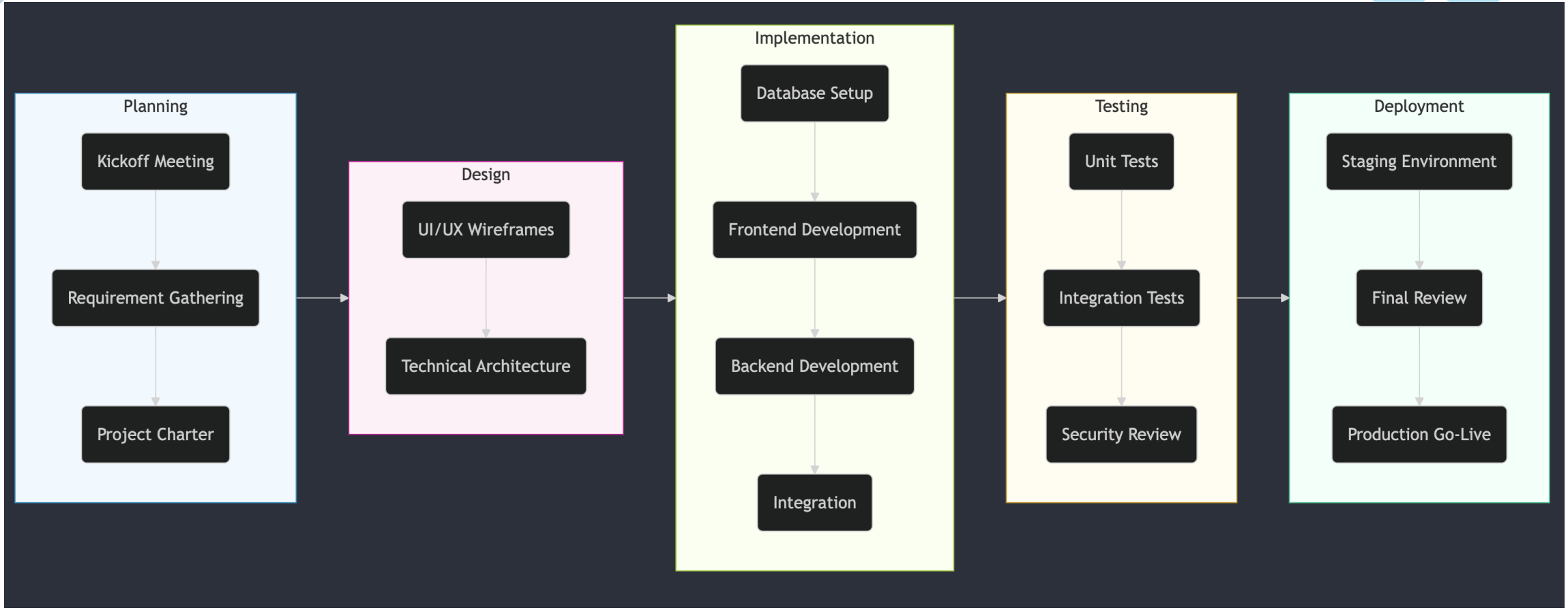
Use agile sprints to gather ongoing input from disabled users, refining sensor calibration and interface accessibility as you go.

- **Quick Risk Identification & Mitigation**

Rapid iterations help detect security, hardware, or usability issues early and address them before they escalate.

- **Seamless Collaboration Across Teams**

Hardware, software, and UX teams coordinate in short cycles, ensuring each component aligns with the larger system goals.

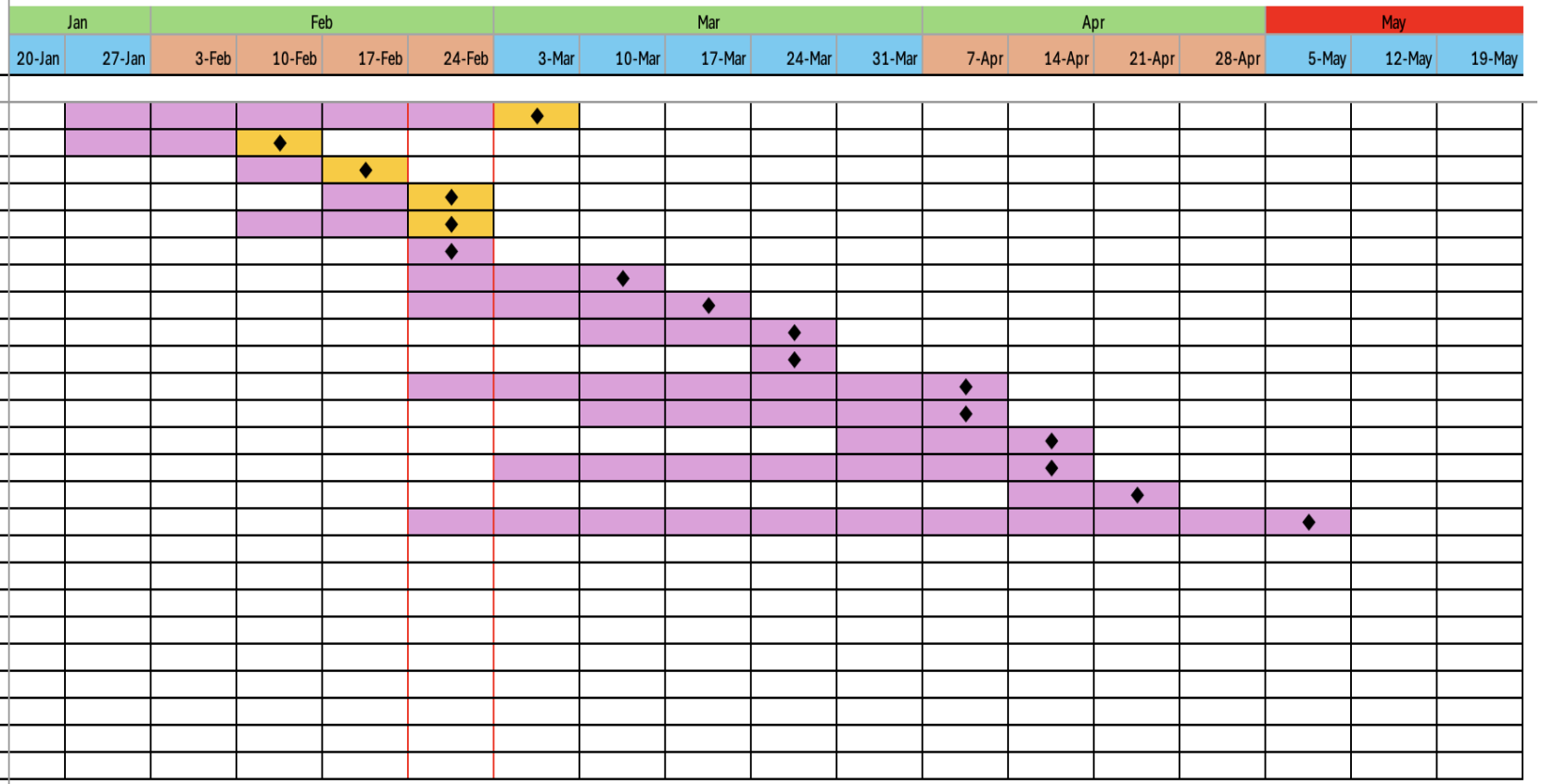

Planning
Kickoff Meeting
Requirement Gathering
Project Charter
Design
UI/UX Wireframes
Technical Architecture
Implementation
Database Setup
Frontend Development
Backend Development
Integration
Testing
Unit Tests
Integration Tests
Security Review
Deployment
Staging Environment
Final Review
Production Go-Live

Project Timelines

Project Start Date: 28-Jan-25

Project Name: Smart Doorbell

#	Activity	Assigned To	Start	End	Days	Status	%Done
1	Brainstorm	All	28-Jan-25	8-Mar-25	29	Completed	100%
2	Finalise idea	All	2-Feb-25	14-Feb-25	10	Completed	100%
3	Create Funding Pitch	Saad	########	22-Feb-25	6	Completed	95%
3	Finalise Funding Pitch	Darsh	########	28-Feb-25	5	Completed	100%
4	Build Facial Recog	Darsh, Saad	########	28-Feb-25	11	Completed	100%
5	Refine Funding P	All	########	28-Feb-25	2	In progress	50%
6	Build App Prot	Megan	########	14-Mar-25	11	In progress	25%
7	Build Pi Prot	Baron	########	20-Mar-25	15	In progress	20%
8	Integrate Pi + App	Megan, Baron	########	25-Mar-25	12	Not started	0%
9	Create Poster	Dan	########	28-Mar-25	4	Not started	0%
10	Plan Demo Vid	Christen	1-Mar-25	7-Apr-25	26	Not started	0%
11	Create Demo Vid	Lavanya	########	10-Apr-25	24	Not started	0%
12	Create Code Cast	Zohaib	5-Apr-25	20-Apr-25	10	Not started	0%
13	Create Draft Sales	Aewaz	5-Mar-25	20-Apr-25	33	Not started	0%
14	Refine Sales Pitch	All	########	25-Apr-25	5	Not started	0%
15	Finalise Project	All	########	5-May-25	47	Not started	0%



Blocked
Completed
In progress
Not started

Potential Risks & Mitigation Strategies

Potential Risks	Mitigation Strategies
Market competition - Many smart door systems exist, making it challenging to stand out.	**Competitive Edge** – Focus on accessibility, solves a problem no other smart doorbells have addressed.
System Failure Risks - Malfunctions could lock users inside or outside, posing safety concerns.	**Reliability & Safety** – Stress testing and implementation of manual override options.
Usability Challenges - Elders and those with low tech literacy may struggle using the system and app.	**User Friendly Design –** Follow WCAG standards, provide accessibility options.

Impact and Benefits

For Disabled people	For security
Easy to open – The door will open automatically via the app or after facial recognition.	**End-to-End Encryption** - All communication between the doorbell and mobile app remains secure and protected from hackers.
Automatically closes – The user will not need to worry about forgetting to close the door.	**Less chance for thieves to enter** – More difficult for thieves to steal a user's phone and access the app than stealing their keys.
Easy to check visitors - The user can use the camera in the doorbell to check who rings the doorbell.	**Visitor detection and alerts** – Facial recognition detects unknown individuals and sends alert to a user's phone
Multiple opening methods – The user still has other ways to enter if they forget one of the ways to open the door.	**Security footage** – The system will store event recordings from the camera for 72 hours.

Any Questions?