



TriMark Corporation UWB Digital Key

Group 9

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Problem statement

- Need for utilizing smartphones to unlock vehicles
 - Convenience
 - Cost savings
 - Prioritize safety
- Features
 - Utilize Ultra Wideband technology
 - Unlock vehicle without a physical key
 - Allow locking/unlocking doors from a certain range of the vehicle
 - Ensure only authorized users have access to their vehicles

TriMark Overview



- TriMark Corporation located in New Hampton, Iowa
- Specialize in door latches and locking systems for commercial vehicles
- Car Connectivity Consortium
 - Global standards for smartphone and in-vehicle connectivity
- Introduced the project to allow digital entry utilizing smart phones
- Commercial vehicle and RV markets



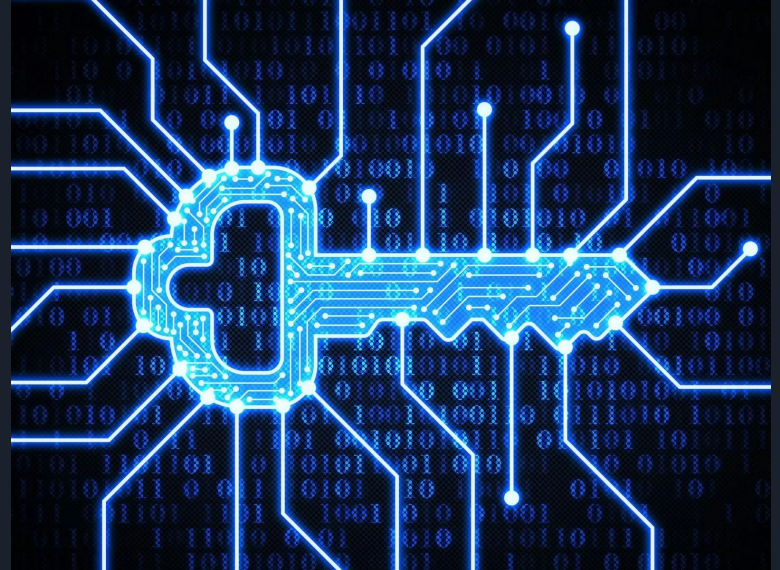
Who are the users?

- RV Owners
- Industrial Vehicle Owners
- Vehicle Manufacturers



User Needs

- All user needs
 - Functioning product with the ability to allow authorized user to lock and unlock the vehicle
 - Easy to use user interface
- User Specific Needs
 - RV owners
 - Industrial Vehicle Users
 - Industrial Vehicle Manufacturers





Requirements

Functional

- Mobile app should be able to unlock/lock a vehicle
- Remote start vehicle
- Add digital key to wallet
- Allow other users access to digital key

Nonfunctional

- Response times are within a reasonable amount of time
- Vehicle should unlock when a digital key is found within 10ft
- Application should use encryption for login credentials
- User interface of the application should be easy to navigate

Use Case

- Unlock when in range and authorized
- Lock when out of range
- Check if phone is inside vehicle





Project Plan

Embedded Development

- Build off of existing *TriMark* hardware and software.
- Integrate in UWB Support using a third party kit from Mobile Knowledge.
- Create UWB to lock actuator connection through soldering the boards together.

Application Development

- Research UWB connection frameworks for App development.
- Deconstruct demonstration app from Mobile Knowledge.
- Employ UWB APIs to create an application that allows the use and management of Keys.

Why have we decoupled the modules in our Project Plan?

- Faster progress
- Lessened learning curve
- Improved efficiency

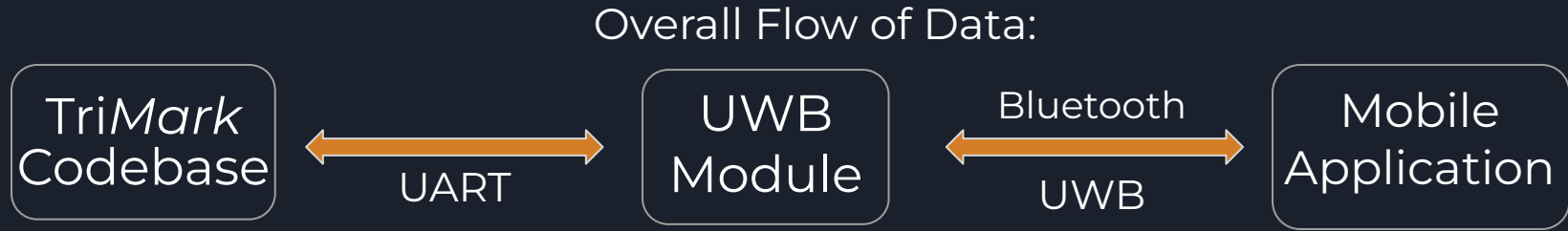


Design Contextualization

Embedded Side

Mobile Application
Side

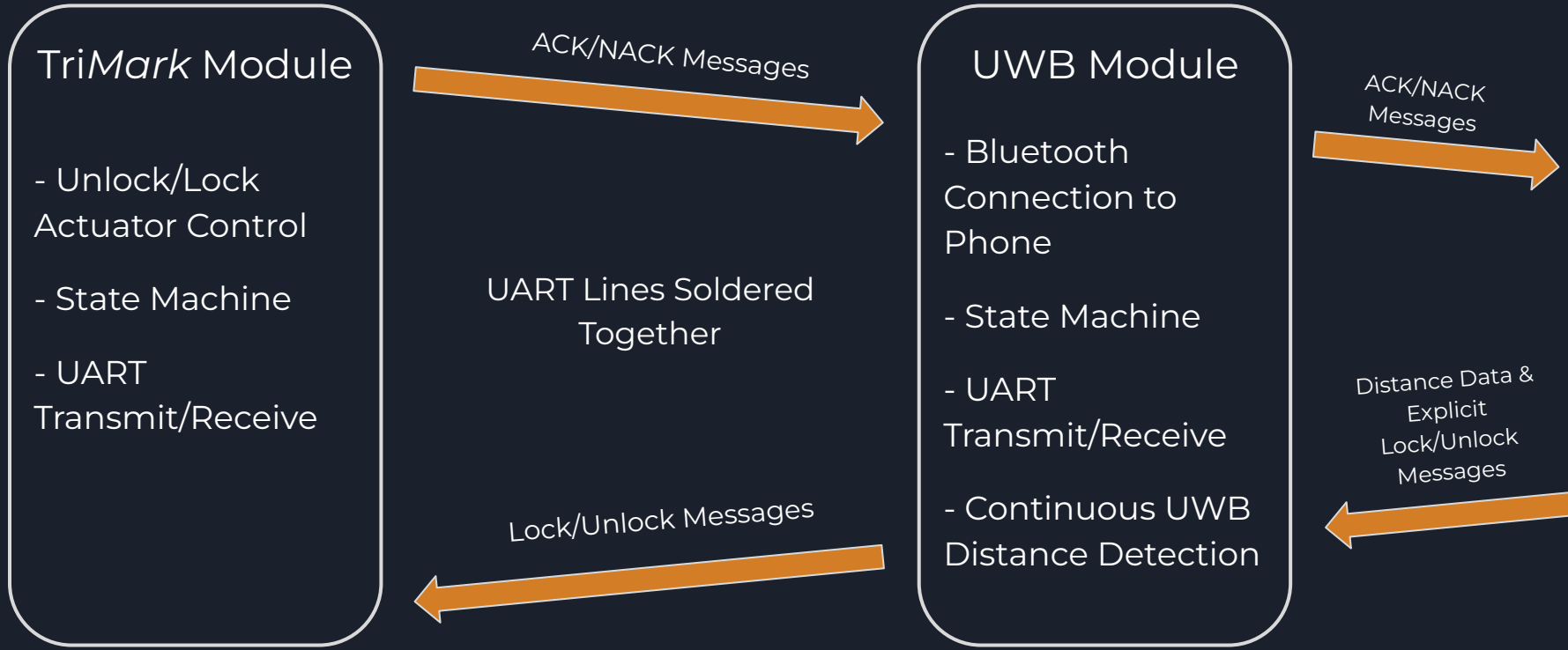
Design Contextualization - Embedded Side



Embedded Scope:

- TriMark Codebase
- UWB Module
- UART communication
- Transmit Data to Mobile Application

Embedded Design Details



Design Contextualization - App Development

- Nearby interactions
- BLE
- U Chip <> UWB

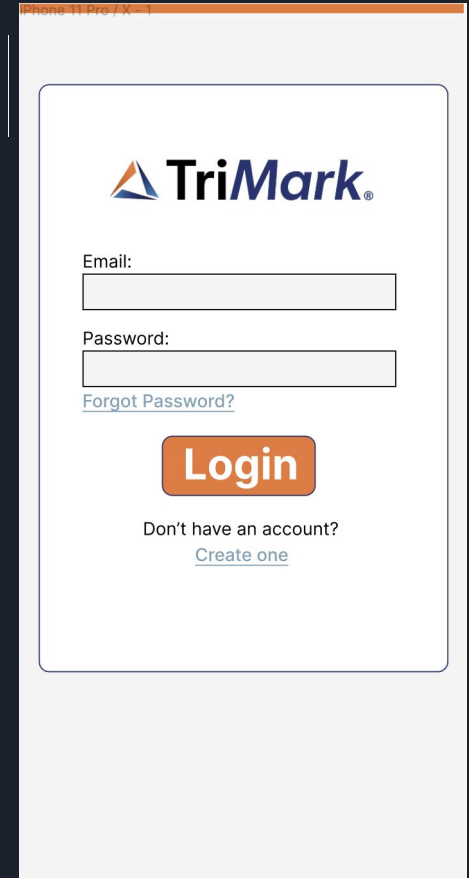
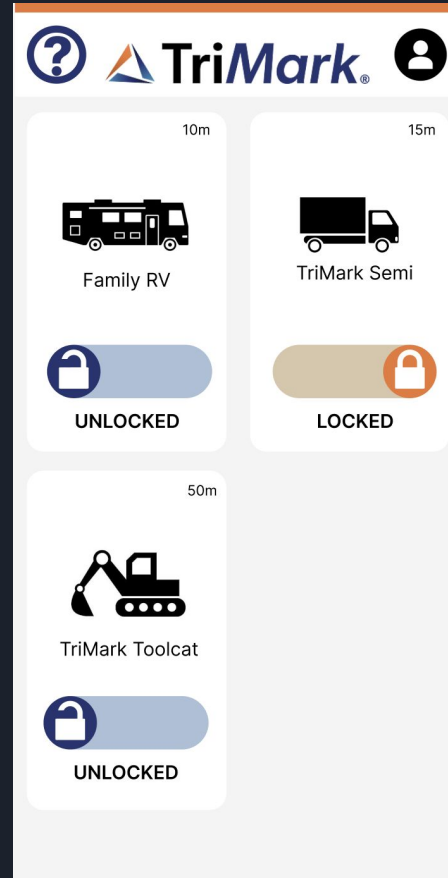


Nearby Interactions with U1

 Developer

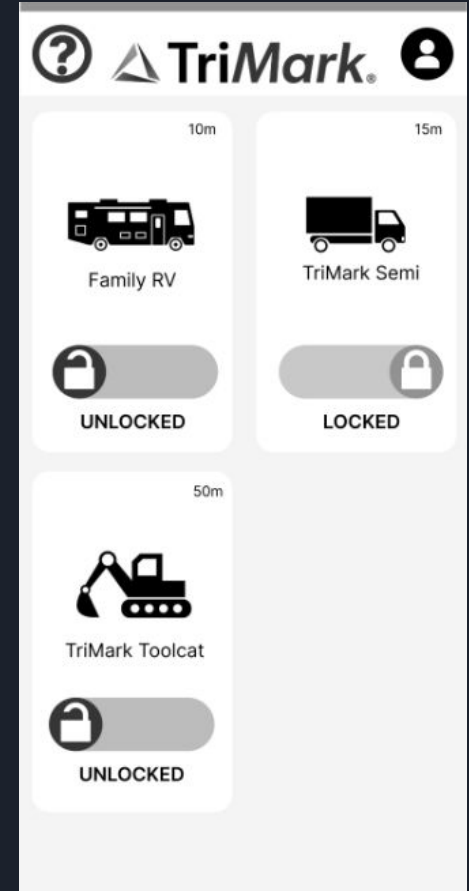
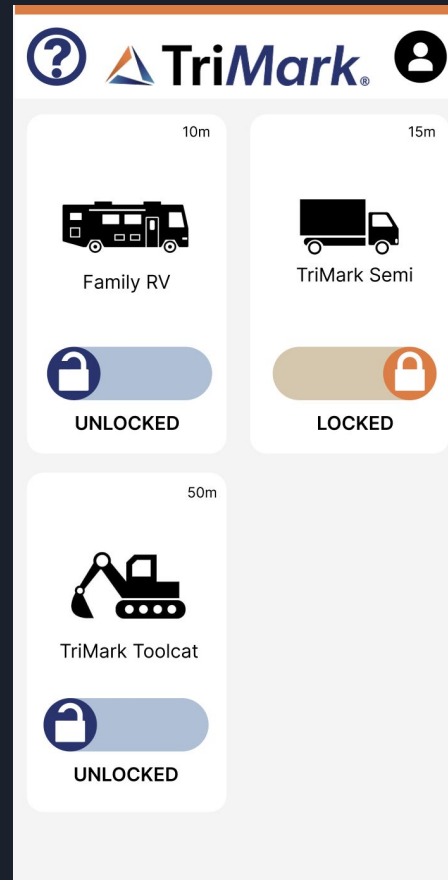
Design Contextualization - Figma Mockups

- Simple functionality
- Accessible to Help
- Color-Scheme Analysis



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Testing

Mobile App Development

- Unit testing with 100% code coverage
- Test response time of functions for best performance
- End User testing

Embedded Testing

- Unit testing of
 - ACK/NACK timeout tests
 - UART Tx/Rx tests
- Stress testing

Security - Embedded

Message Encryption

- AES128 encryption & decryption for each message sent

Random Seed

- Random seed given to each message sent & expected to be in message acknowledgement received
- Eliminates ability of hackers to record and replay messages- random number will be different

Encrypted Random Number & Message

AES Encrypt

TriMark
Module

AES Decrypt

AES Decrypt

iPhone
Application

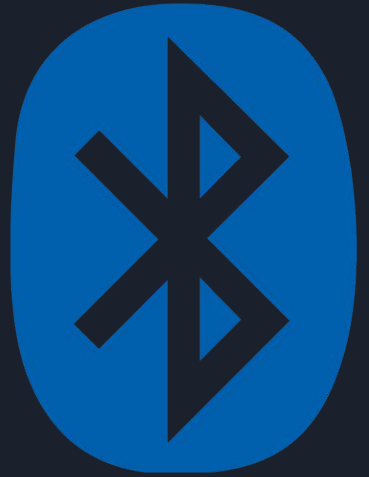
AES Encrypt

Encrypted Random Number & Acknowledgment



Security - Mobile App

- Bluetooth and UWB
- Encrypted credentials
- Future sustainable security measures!





Future of Digital Keys

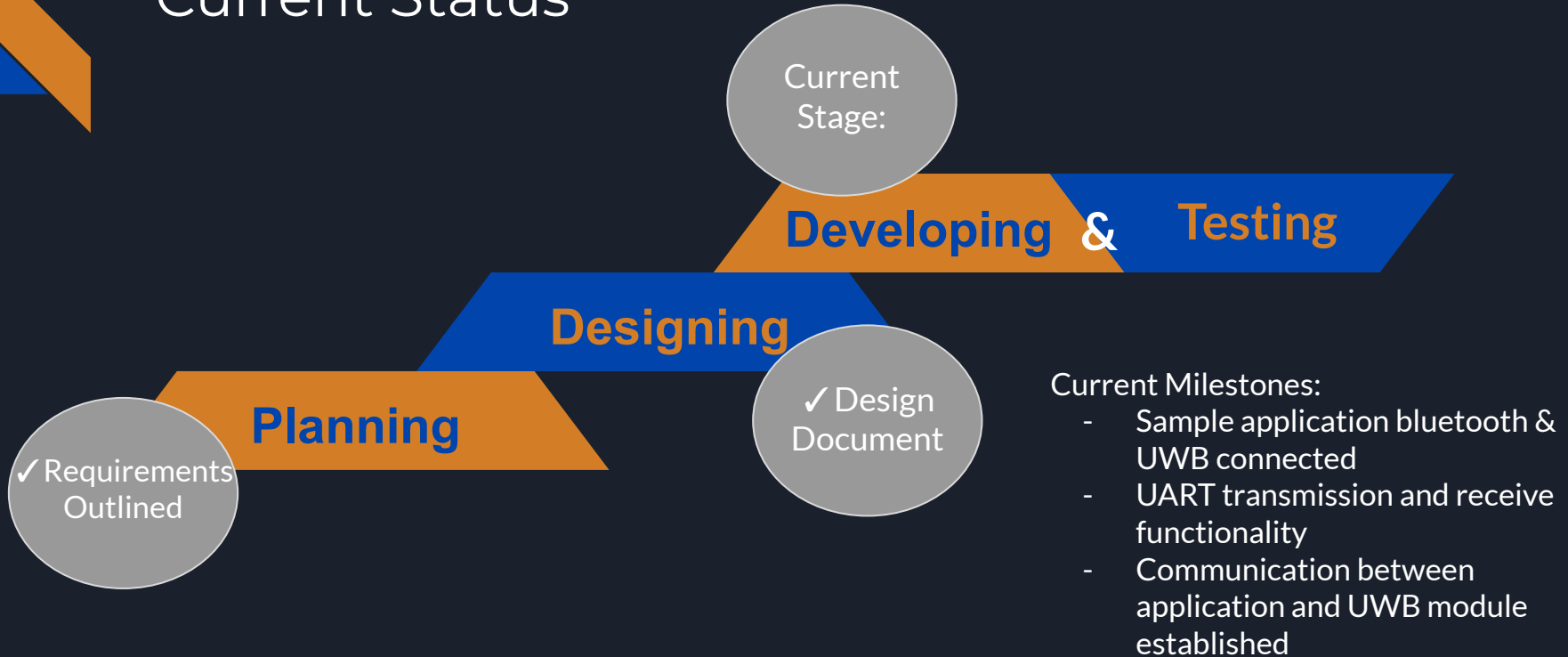
Future Functionality

- Finding bounds of the vehicle
- Push to start capabilities
- Turning on lights
- Capacitive sense door handle

Potential Issues

- Determining bluetooth priority
- Bluetooth within the vehicle potentially interfering with Nearby Interactions

Current Status



Questions?

