CEng 491 -- Project KickOff Document

BikeSharing KickOff Document

Description

Cycling is enjoying a favourable press the world over as a “a good thing” in the economic, environmental and social spheres. Due to the increasing urban problems (air quality, congestion, noise etc..) with the increasing population and private-vehicle ownership rate, the bike sharing systems have started to get popular and widely supported by the public around the world.

The end product will be secure and easy-to-use bike sharing system that will increase the mobility of the public transportation users. The project consists of three main components: mobile application, cloud-based central software and smart lock. The project will use smart lock sensors to connect bikes to a central cloud platform and establish bi-directional communication between the field and center. One of the most beneficial usage areas of “smart lock” system is the primarily asset tracking/security and secondarily integrated payment in smart cities context. The central software will be used to manage the system and keep the data which is collected from smart lock sensors and users. The mobile application will be used to rent a bike by scanning QR code of the bike and complete the payment process via in-app purchase method. Every person which is actively using public transportation will be the expected users of the project.

Master Feature List

MF-1 The mobile application will have a secure payment system

MF-2 Easy to use Mobile Application

MF-3 Quick match between Mobile Phone & Smart-lock

MF-4 The system will be able to securely store the user data

MF-5 Identification

MF-6 GPS Tracking

MF-7 Secure Payment Process

MF-8 Collecting Data in Central Cloud Software

MF-9 Long Battery Life

MF-10 Automatic lock & unlock when matching succeed

MF-11 IP6 Waterproof case to prevent from rain

MF-12 Stable & durable hardware

MF-13 Real-time submitting location data to Central Software

MF-14 Providing the users' statistics via Mobile Application

MF-15 (BONUS) ~110 dB Alarm in real time on your smartphone

Workpackages

WP #	Term	WP title (this should be as short and as descriptive as possible)	Estimated number of person-months
1	491	Project planning and architecture design	3
2	491	Literature Research	4
3	491	Mobile Application GUI Development	4
4	491	Mobile Application System Development	4
5	491&492	System & Payment System Algorithm Development & Integration	5

6	492	Preparing the Cloud Server for the project	4
7	492	Creating backend services	4
8	492	Integration and Testing	2
		Total:	30

Detailed Descriptions of High-Level Workpackages

WP1 - Project planning and architecture design

In this workpackage, the following functionalities / features / work items will be implemented

1. Develop the list of master features of the project.
2. Produce project development plan in accordance with Master Feature List.
3. Design the overall architecture of the project.
4. Analyze risks and make a management plan.

WP2 - Literature Research

1. Reading papers related to the project
2. Each group member will summarize the papers that he reads
3. Searching for similar products
4. Research about suitable programming languages and technologies (frameworks ,platforms etc.) which we can use.
5. This process will be spread through the year. Literature research will be done before each sprint.

WP3 - Mobile Application GUI Development

1. Login and Sign up screen.
2. GUI for the lock & unlock process.
3. GUI for analysis.
4. Testing

WP4 - Mobile Application System Development

1. Integrating payment method.
2. Map for tracking the positions of the bikes.
3. Alarm Notification
4. Testing

WP5 - System & Payment System Algorithm Development & Integration

1. Using In-app purchase service for payment.
2. Using the existing libraries and APIs for in-app purchase service development.
3. Logging and authentication with identity number algorithm.
4. Scanning QR code on smart-lock algorithm.
5. Sending data to the cloud system algorithm.
6. Testing

WP6 - Preparing the Cloud Server for the project

1. Registering to a suitable Cloud Server Provider
2. Connecting smart-locks that placed on bikes to cloud server.
3. Store the data about and received from smart-locks into the remote database.
4. Testing

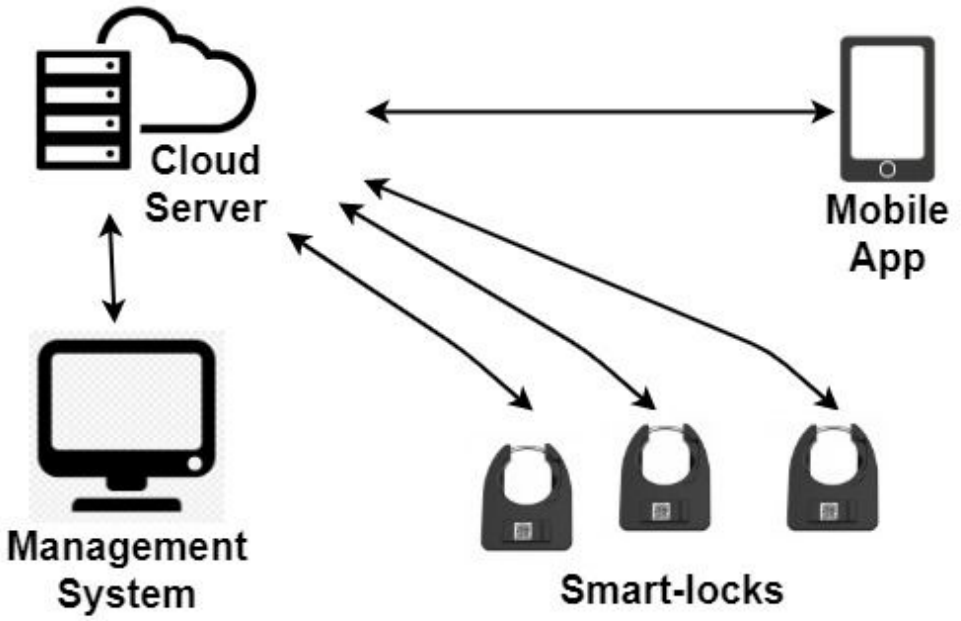
WP7 - Creating backend services

1. Creating tables in database.
2. Interface for Create, Read, Update, Delete operations.
3. User authentication.
4. Using a notification application to alarm users in case of displacement of a bike.
5. Testing

WP8 - Integration and Testing

1. Testing compatibility between components
2. Automated unit and integration tests.
3. UI testing with real-users
4. Live testing of the project

Overall Systems Architecture



The mobile application will enable the automatic opening/closing and start/end of the payment process for bikes equipped with smart locks which are placed on fixed positioned bike dockers (parking lots)

1) The user logs in to the mobile application via its identity number. (Enables the tracking for possible theft scenarios)

2) Scans the QR code on "smart lock" placed on the bike and opens the bike placed in fixed positioned bike docker. The payment process starts and the user is started to

be tracked via mobile phone's GPS. (GPS data is sent to the cloud system via the mobile application)

3) The user goes to another bike docker and scans the QR code again and locks the bike on the bike docker. The payment process stops and the data is sent to the cloud system via the mobile application. In case of the theft, the user can be identified via the identity number which is entered in the first step.

Timeline

Start Date	End Date	Work Packages
15.10.2019	**12.11.2019**	**Literature Research**
12.11.2019	**17.12.2019**	**Mobile Application GUI Development**
17.12.2019	**14.01.2020**	**Mobile Application System Development**
14.01.2020	**25.02.2020**	**System & Payment System Algorithm Development & Integration**
25.02.2020	**24.03.2020**	**Preparing the Cloud Server for the project**
24.03.2020	**21.04.2020**	**Creating backend services**
21.04.2020	**26.05.2020**	**Integration and Testing**

Risk Assessment

Risk #	Description	Possible Solution(s)
1	The primary hardware components (smart locks) and the integration of this hardware with mobile applications.	Parabol will provide guidance/mentorship and support for hardware procurement.
2	Payment system	In-app purchase service (Google Play, AppStore), another way of using an existing payment processing system's infrastructure. the project team will use the existing libraries and APIs for in-app purchase service development. (Third-party open source)
3	the lack of this component and the lack of previous knowledge	Much more Research
