



Tunisian Republic
Ministry of Communication Technologies
and the Digital Transformation
Ministry of Higher Education and Scientific
Research
University of Carthage
Higher School of Communications of Tunis



SCOPE OF STATEMENT

SMART PARKING BASED ON COT

Realised by

AZZOUZ IMEN
TOUMI MOHAMED AMINE

Supervised by

Dr. Kaâniche Mohamed-Bécha

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Introduction

In recent times, the importance of transportation has gradually increased in order to be able to execute daily tasks such as going to work in the least time possible; hence, automobiles were a critically acclaimed solution that helped save the time otherwise wasted in mobility, and thus becoming a quintessential part in our lives. However, due to the unreliability of public transport in Tunisia, people have opted more for personal cars despite their huge price, since these cars provided independence and freedom of movement to their owners. Therefore, the number of car owners keeps rapidly growing. In fact, the number of car owners in Tunisia is 2072000 [1] which represents a fifth of its population. The rising demand for cars has inadvertently led to a huge loss in the time of drivers because the massive increase in cars circulating in the country has led to an even bigger rise of traffic congestion. This congestion has also affected parking, as empty parking slots have become a rare sight to be seen. This phenomenon is also observed in many different countries. A latest study in New York City [2] reveals that drivers spend 9 hours on average per year searching for an available parking location which costs them 2243 dollars yearly. This report aims to tackle this issue by designing a Smart Parking that informs the client of the available parking spots. This way, search time is greatly reduced and the traffic congestion becomes less prominent. This report is divided into two sections. The first section pertains to the proposed solution architecture of the smart parking in which the hardware components and the software technologies are detailed. The second section focuses on the realization of the solution.

1 Objectives

The goal is to offer a system that makes it easy to find an empty parking space and help customers save time and automate parking monitoring for park owners.

2 Fonctionnalités

By realizing this project, we aim to:

- Parking access management: If the system recognizes the user's license plate, the barrier opens automatically. It is an automation and management system for parking areas.
- Parking slots reservation: car owners can reserve a parking slot
- Power saving: Detect the presence of the car and make sure to set the light on when a car or person is detected nearby a parking slot.
- Time saving: car owners can save much time by reserving beforehand a parking spot.
- Mobile application :
 - The ease of use of the application for iOS and Android users
 - The car owners can register in the smart parking service
 - Check for the availability of empty parking spots.

- Dashboard :
 - Parking owners can see the history of parking users and their car licence plates
 - Parking owners can optimise the electricity consumption

3 Components

- Raspberry Pi : The Raspberry Pi is a credit card sized nano computer that can be connected to a monitor and used like a standard computer. Its small size, and its interesting price makes the Raspberry PI an ideal product to test different things. The Raspberry Pi will be the microcontroller for the smart parking project. It will be responsible for dealing with the information coming from/to the sensors.
- Pi Camera : The Pi Camera is the camera module of the Raspberry Pi. It allows high resolution image captures or video recordings.
- Sensors :
 - Photo-resistors: Measures of the luminosity in a parking zone.
 - Ultrasonic sensor: Measures the presence of cars in the entrance and exit of the parking
 - Motion sensor: Detects the motion of car/person in a parking zone
- Resistors
- LEDs
- Servomotor SG90

4 Functional architecture

- Front-end
 - Flutter: Flutter is a cross-platform SDK that gives the ability to develop applications for multiple platforms based on a single code. Flutter grants access to native functionalities and native look without using frameworks such Apache Cordova or Capacitor. Flutter apps are easy and fast to code and do not require web development prior knowledge.
- Middleware
 - JAKARTA EE : A highly server-oriented platform for the development and execution of distributed applications.
 - WildFly : WildFly is an application server compliant with Jakarta EE specifications.
- Backend
 - MongoDB : MongoDB is a document-oriented NoSQL database used for high volume data storage. Instead of using tables and rows as in the traditional relational databases, MongoDB makes use of collections and documents.
 - MQTT: MQTT is a lightweight, publish-subscribe, machine to machine network protocol for messaging the data sensors.

- Node Red : Node-RED is a programming tool for wiring together hardware devices, APIs and online services.

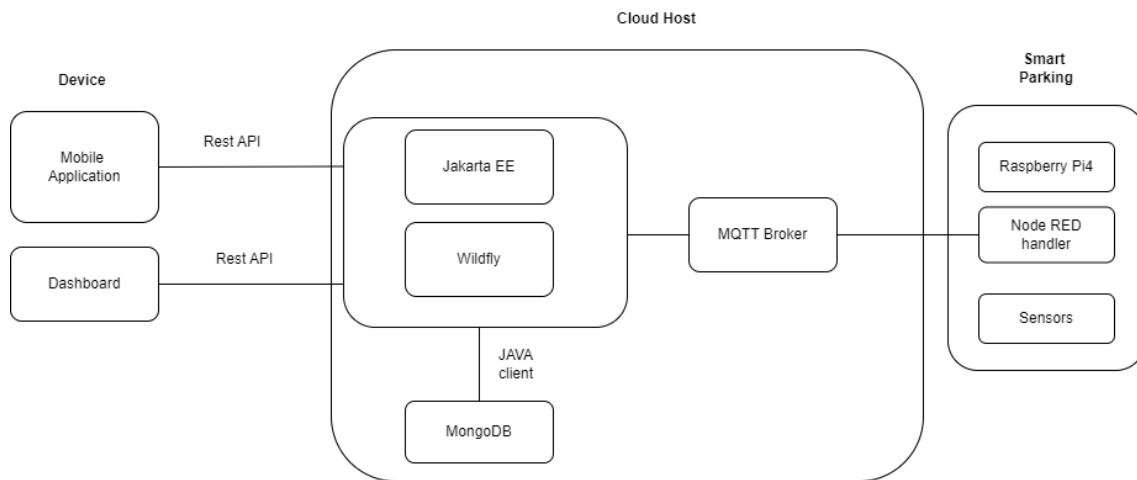


Figure 1: Functional architecture

5 System design architecture

Our system will be composed of a Raspberry Pi (6), photoresistor (1), LEDs (2), ultrasonic sensor (3), Pi camera (4) and servo motors (5)

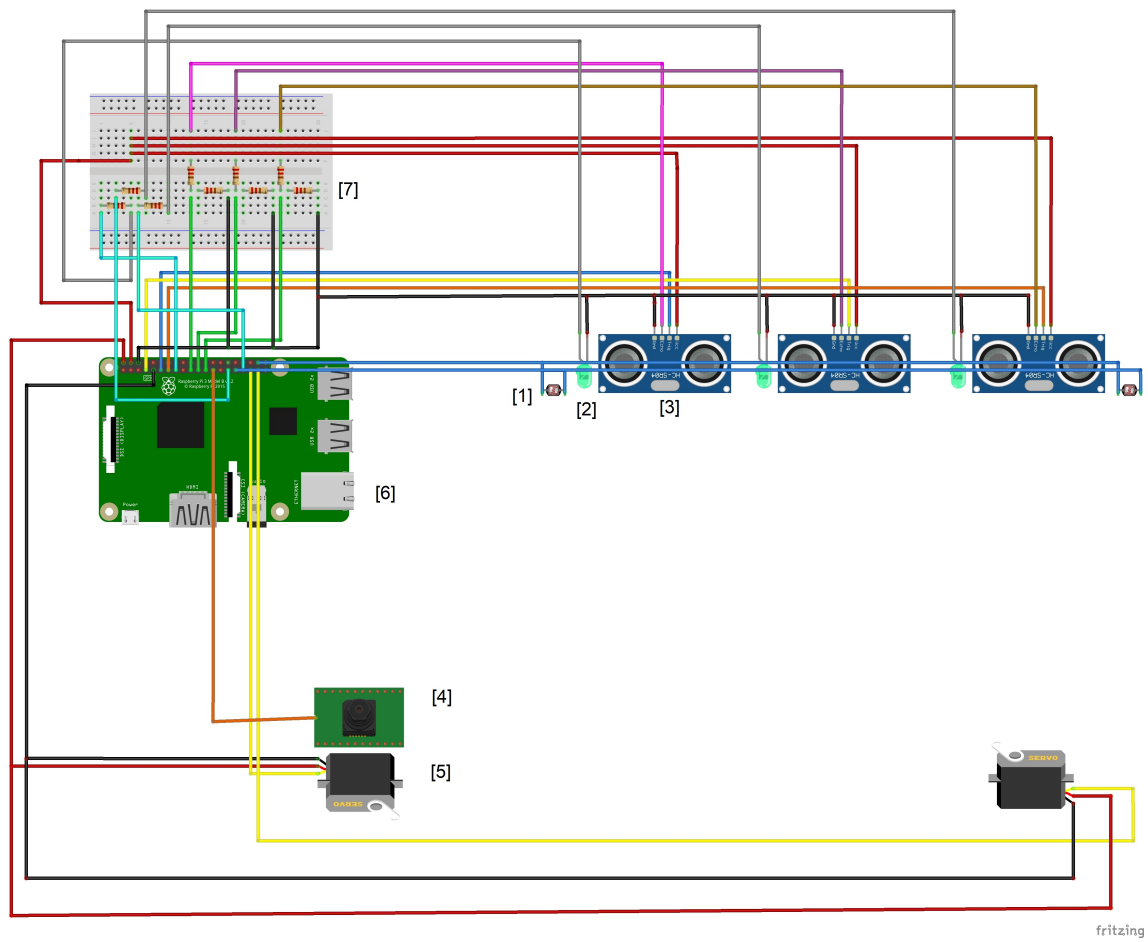


Figure 2: System design architecture

6 Constraints

The realization of the Smart parking system must be achieved no later than 8 January 2023 with all the demanded fonctionnalities listed above.

7 Deliverable

By the end of this project, these requirements must be delivered:

- Scope of statement: A document that defines all the elements of the project scope as well as assumptions and project requirements
- Source code: The source code for the different parts of the project
- Design document: A document that describes the architecture of the application the functionalities and differents components using diagrams
- Demo: A video that contains a demonstration of the proposed solution.

8 Business Marketing study

Our marketing and business study is based on 3 main parts : the SWOT analysis, the business model canvas and the marketing mix.

8.1 SWOT analysis

A SWOT (strengths, weaknesses, opportunities and threats) analysis looks at internal and external factors that can affect our business. Internal factors are our strengths and weaknesses. External factors are the threats and opportunities.

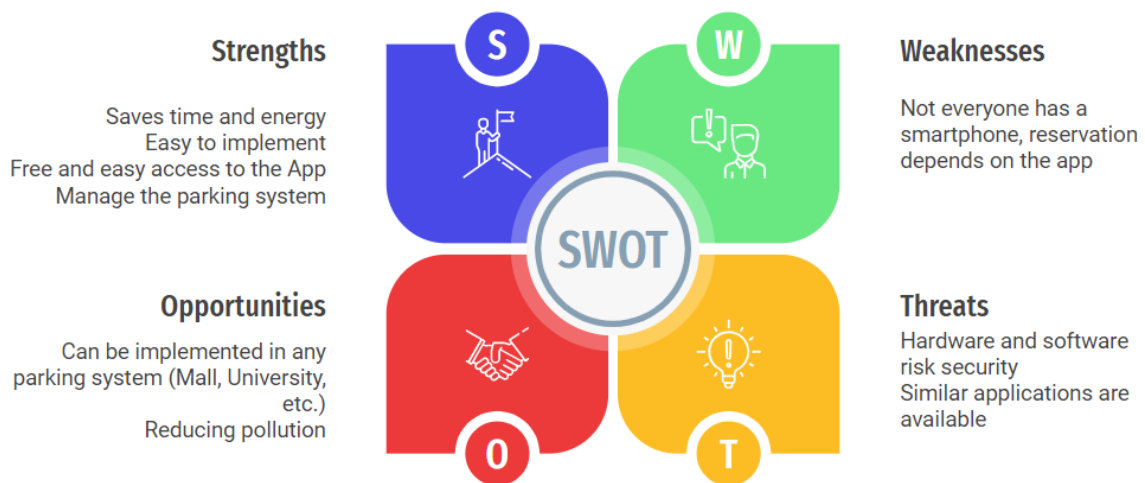


Figure 3: SWOT analysis

8.2 Business Model Canvas

The Business Model Canvas is a business tool used to visualise all the building blocks to start a business, including customers, route to market, value proposition and finance.

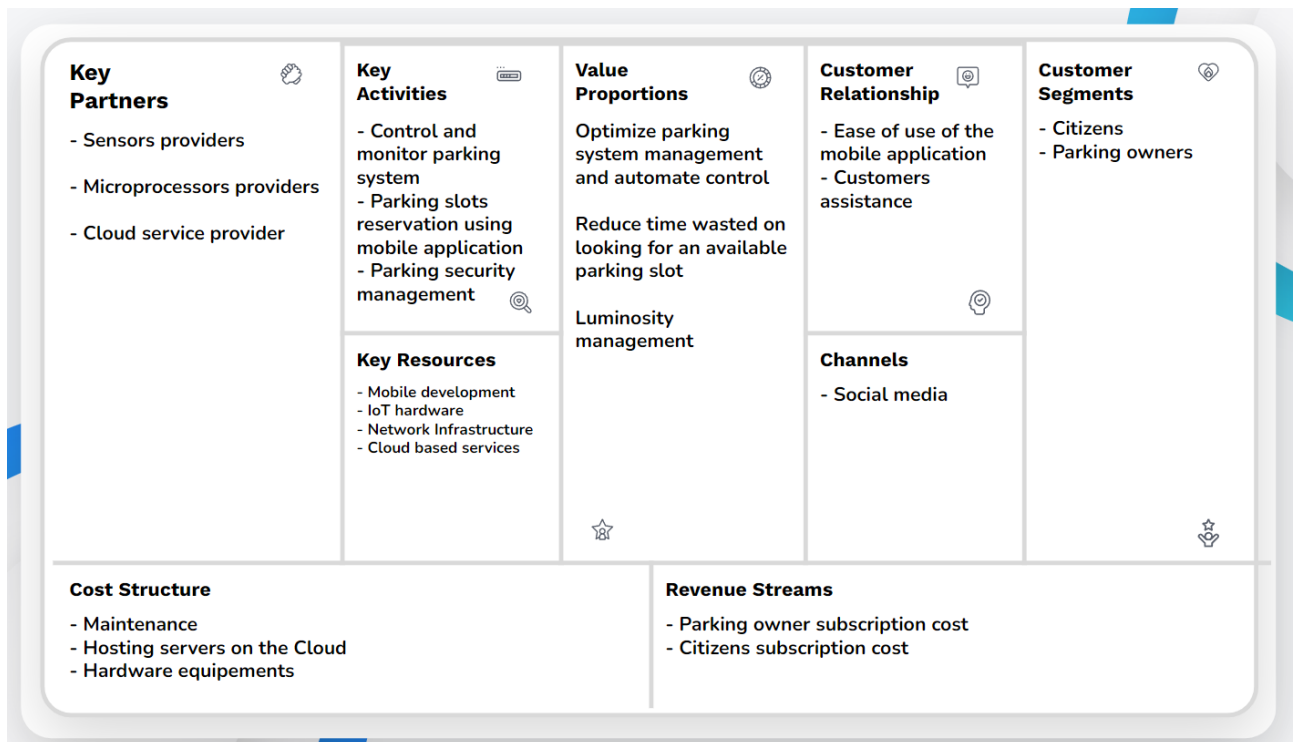


Figure 4: Business Model Canvas

8.3 4P Marketing Mix

The four Ps are the key considerations that must be thoughtfully considered and wisely implemented in order to successfully market a product or service. They are product, price, place, and promotion.

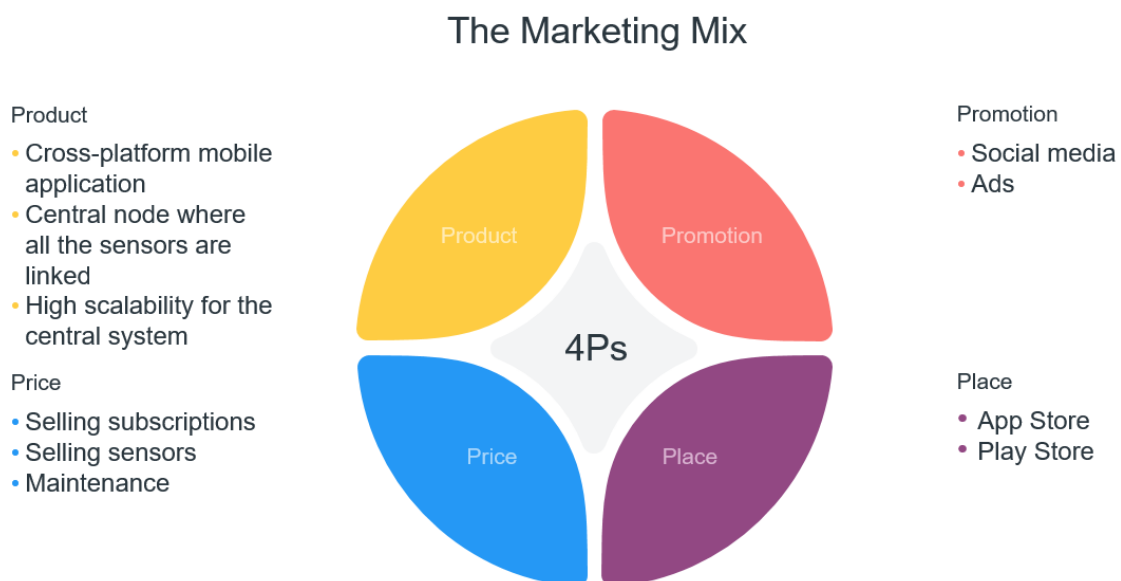


Figure 5: 4P Marketing Mix

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- [2] New York City study. URL: <https://www.cnbc.com/2017/07/12/drivers-spend-an-average-of-17-hours-a-year-searching-for-parking-spots.html>.