Remote Keyless Entry & BiCom System

Report

Group No.: 36

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Module: Getting Started with ARM Based Microcontroller

Document History

Ver. Rel. No.	Release Date	Prepared by	Reviewed by	Remarks/ Revision Details
1.0	March 11, 2022	Shashwat Sinha	Team	--

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1. About

1.1 Problem Statement

- *Remote Keyless Entry:*
  The RKE system should unidirectionally perform operations like locking/unlocking the car, activating/deactivating alarm through the RKE key fob to the body control ECU which is intergrated with RKE.

- *Bicom System:*
  The BiCom system should perform the unidirectional features of the RKE. Along with that it should also communicate from the car to key fob by sending car status information to the keyfob display.

1.2 Solution

- *Remote Keyless Entry:*
  To implement the following system our project performs these operations:
  - To lock the car: Print lock (Blue switch on- All led on at the same time).
  - To unlock the car: Print unlock (Blue switch press two times- All led off at the same time).
  - To activate/deactivate alarm: Print alarm activation/deactivation (Blue switch press three times- All led on in clockwise manner).
  - To turn on approaching lights: Print approach light (Blue switch press four times- All led on in anti-clockwise manner)

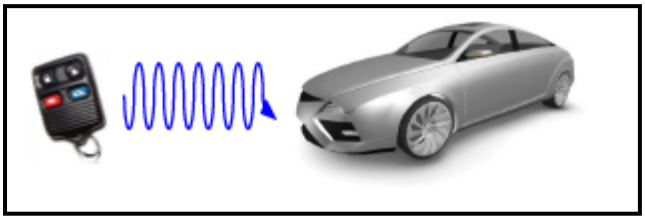
- *Bicom System:*
  To implement the following system our project performs these operations:
  To show window status:
  - Print window status (Blue switch on- All led on at the same time).
  - To show alarm status: Print alarm status (Blue switch press two times- All led off at the same time).
  - To show car's battery status: Print car battery info (Blue switch press three times- All led on in clockwise manner).
  - To show door status: Print door status (Blue switch press four times- All led on in anti-clockwise manner).

1.3 Abstract

- *Remote Keyless Entry:*
  Remote keyless entry (RKE) system is a system designed to perfom remote lock or unlock access to automobiles. Here, the RKE transmits the specific

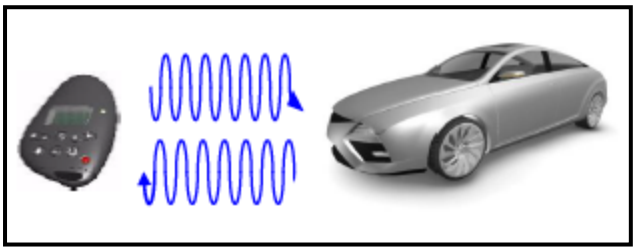
frequency radio wave to the receiver and the specified operation is completed. RKE has captivated automobile buyers, as evidenced by its popularity on new vehicles and as an aftermarket item. This project provides an overview of RKE systems and its functional design and requirements along with its analysis on various fronts and implementation.

The RKE system should unidirectionally perform operations like locking/unlocking the car, activating/deactivating alarm through the RKE key fob to the body control ECU which is intergrated with RKE.



- *Bicom System:*

  A BiCom system is the extention of the unidirectional RKE to bidirectional RKE system. This BiCom system offers increased security compared to uni-directional RKE system. Here, the key fob authenticates the vehicle before replying. Meaning the RKE transmits the specific frequency radio wave to the receiver and then the vehicle authenticates the fob by transmitting the status back. This project provides an overview of BiCom systems and its functional design and requirements along with its analysis on various fronts and implementation.



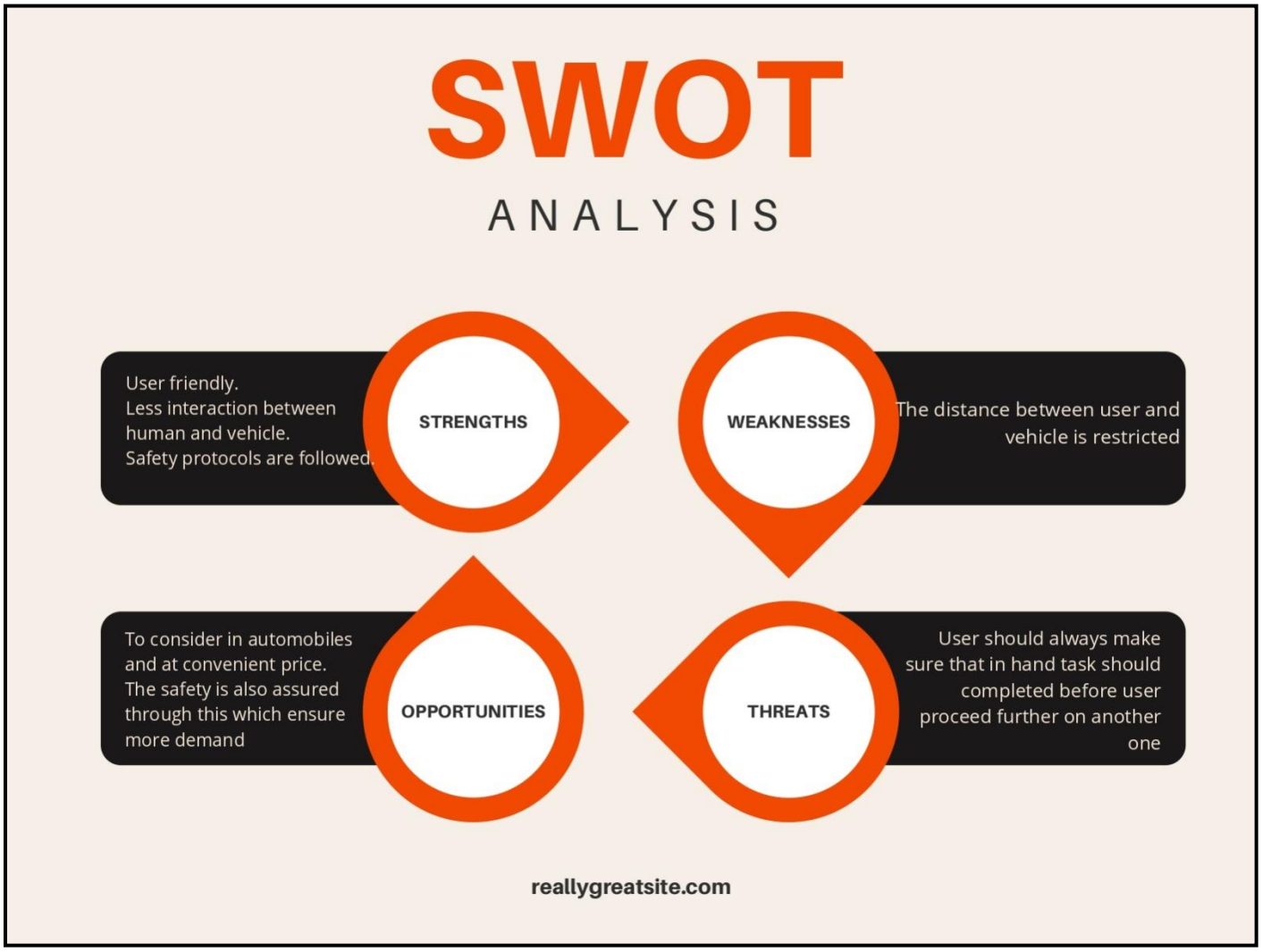
1.4 Features

- *Remote Keyless Entry:*
  - Car is locked when the switch is pressed once.
  - Car is unlocked when the switch is pressed twice.
  - Alarm of the car gets activated/ deactivated when the switch is pressed thrice.
  - Approaching lights are turned on when the switch is pressed four times.

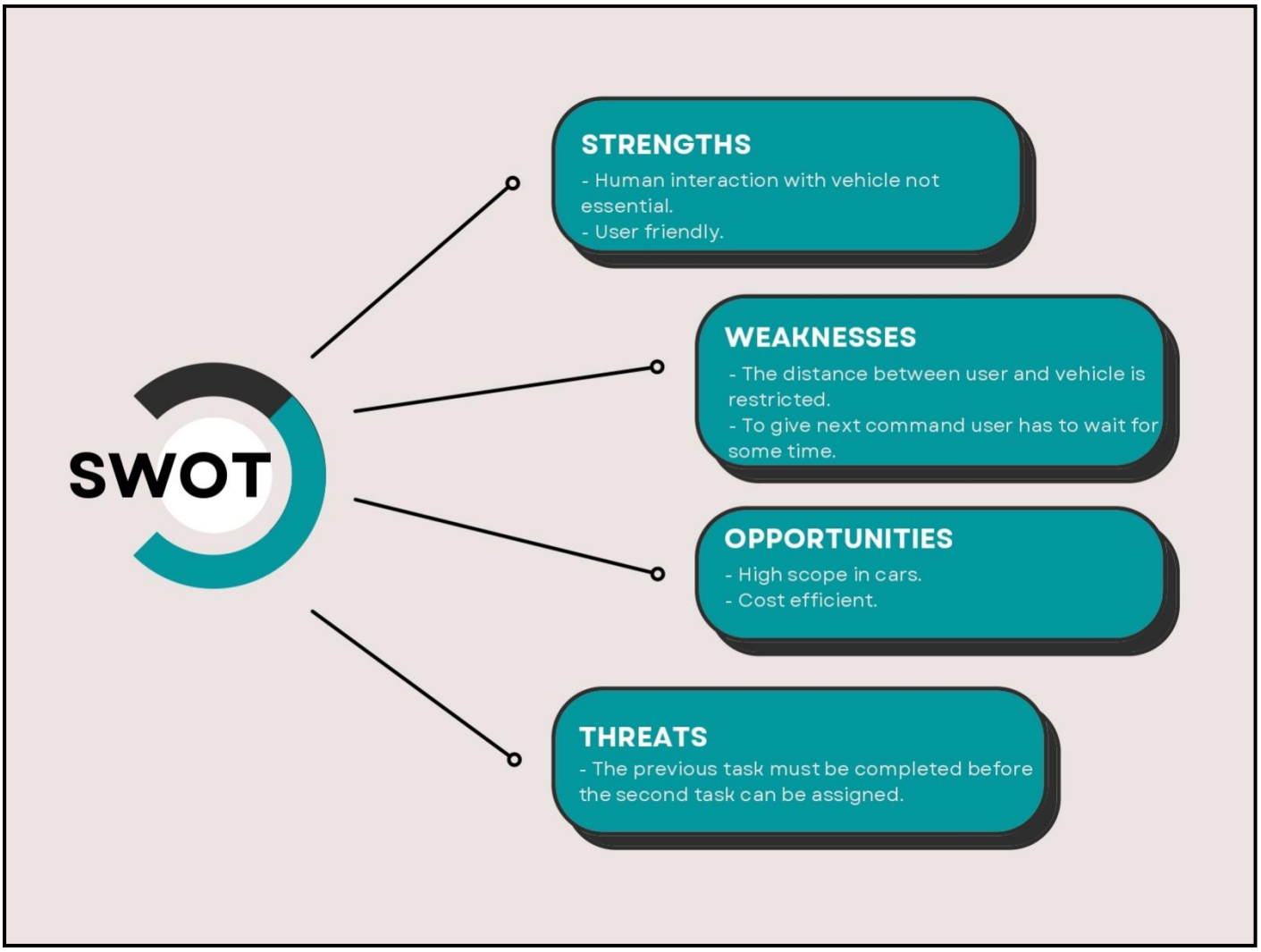
- *Bicom System:*
    - Window status of the car is displayed when the switch is pressed once.
    - Alarm status of the car is displayed when the switch is pressed twice.
    - Battery status of the car is displayed when the switch is pressed thrice.
    - Door status of the car is displayed when the switch is pressed four times.

1.5 SWOT Analysis

- *Remote Keyless Entry:*

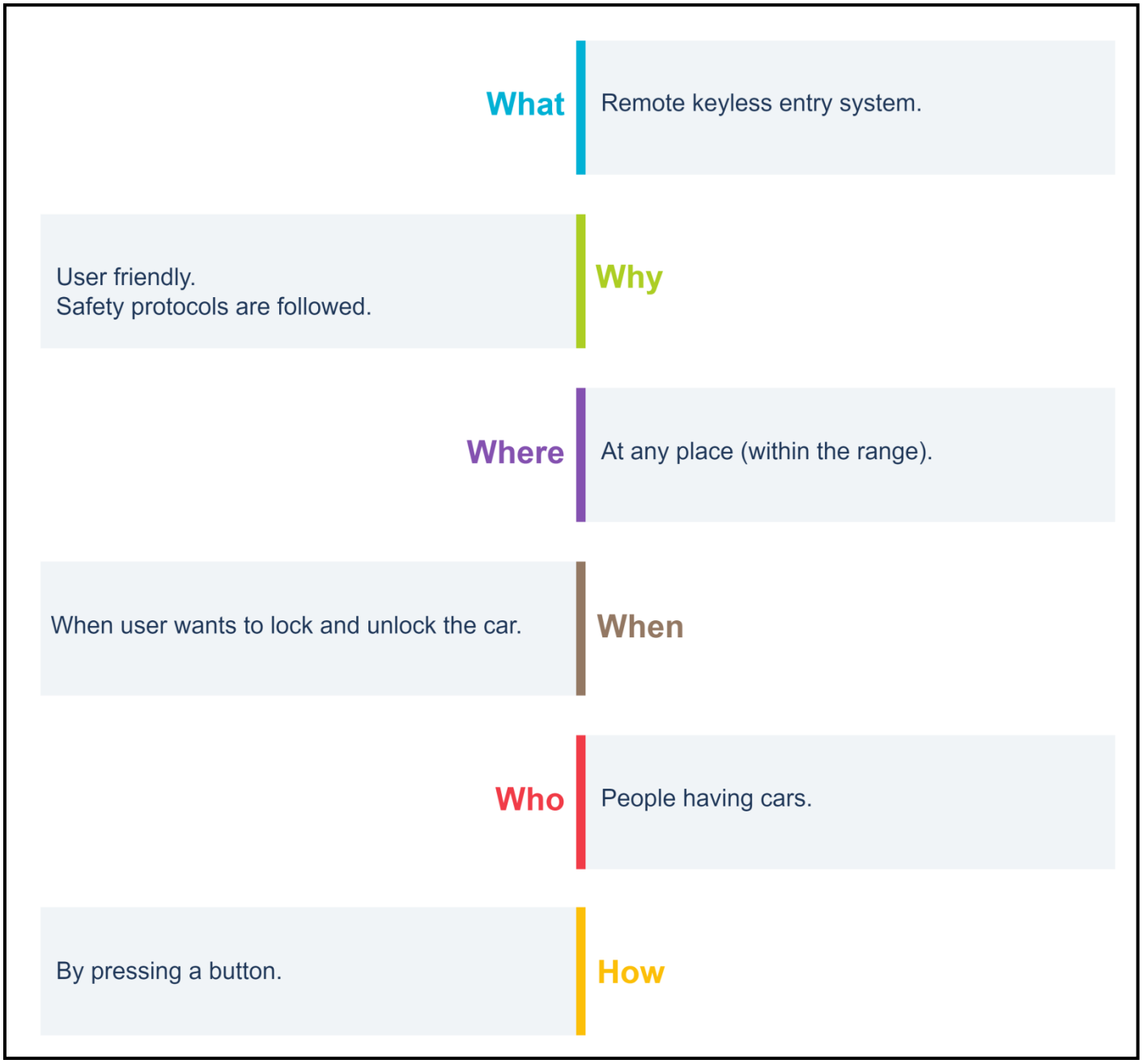


- *Bicom System:*

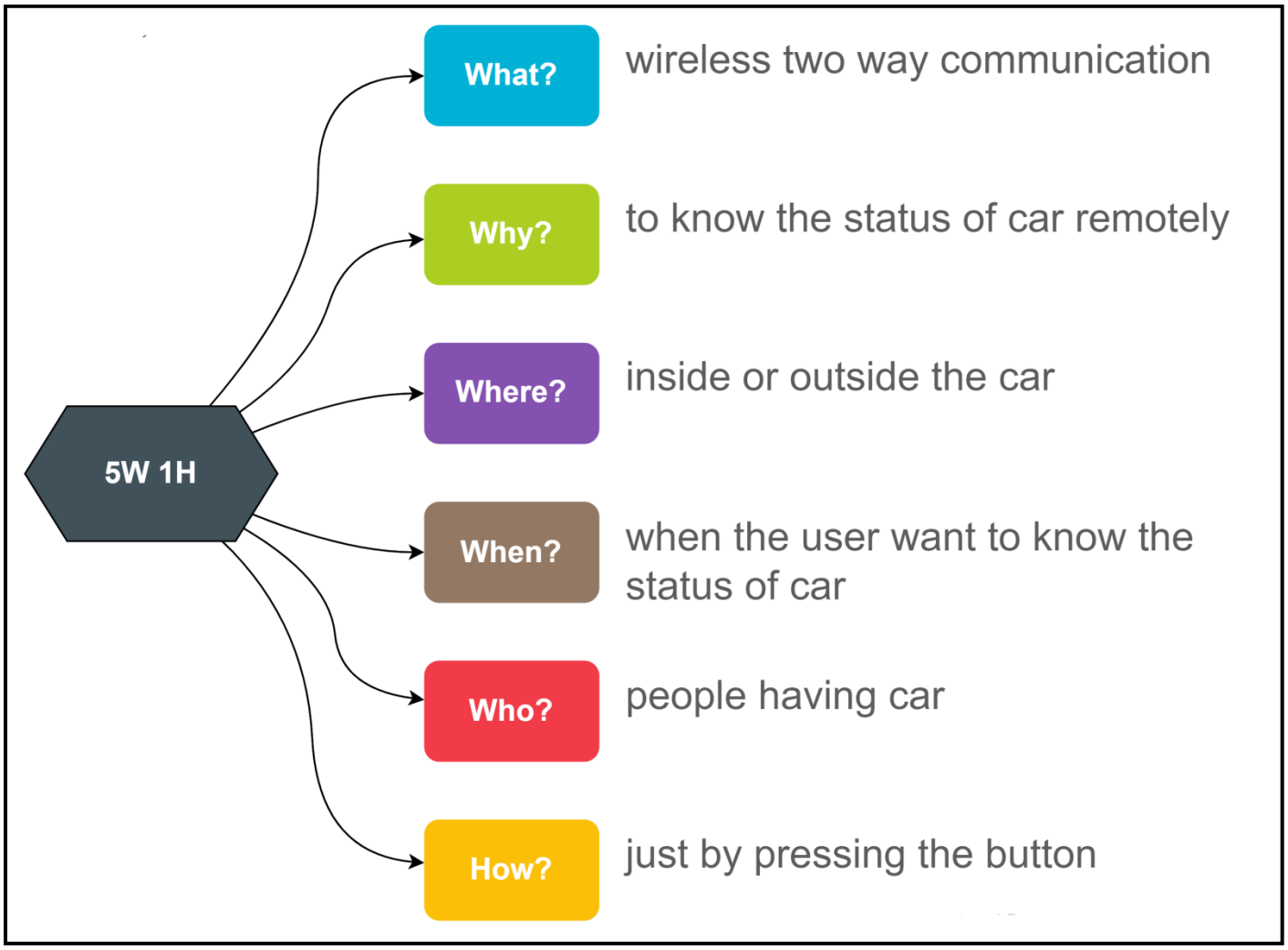


1.6 5W's and 1H

- *Remote Keyless Entry:*



- *Bicom System:*



2. Requirements

a. High Level Requirements

- *Remote Keyless Entry:*

ID	Description
HLR0.1	Must be able to remotely lock the vehicle
HLR0.2	Must be able to remotely unlock the vehicle
HLR0.3	Must be able to remotely activate/deactivate the vehicle's alarm
HLR0.4	Must be able to remotely turn on vehicle's approach lights

- *Bicom System:*

ID	Description
HLR1.1	Must display the window status of the vehicle
HLR1.2	Must display the alarm status of the vehicle
HLR1.3	Must display the battery status of the vehicle
HLR1.4	Must display the door status of the vehicle

b. Low Level Requirements

- *Remote Keyless Entry:*

ID	Description	HLRID
LLR0.1	Vehicle must get locked when blue switch is pressed once	HLR0.1
LLR0.2	All LEDs must turn on when blue switch is pressed once	HLR0.1
LLR0.3	Vehicle must get unlocked when blue switch is pressed twice	HLR0.2
LLR0.4	All LEDs must turn off when blue switch is pressed twice	HLR0.2
LLR0.5	Alarm must be activated/deactivated when blue switch is pressed thrice	HLR0.3
LLR0.6	All LEDs must turn on in clockwise manner when blue switch is pressed thrice	HLR0.3
LLR0.7	Vehicle's approach light must turn on when blue switch is pressed four times	HLR0.4
LLR0.8	All LEDs must turn on in anti-clockwise manner when blue switch is four times	HLR0.4

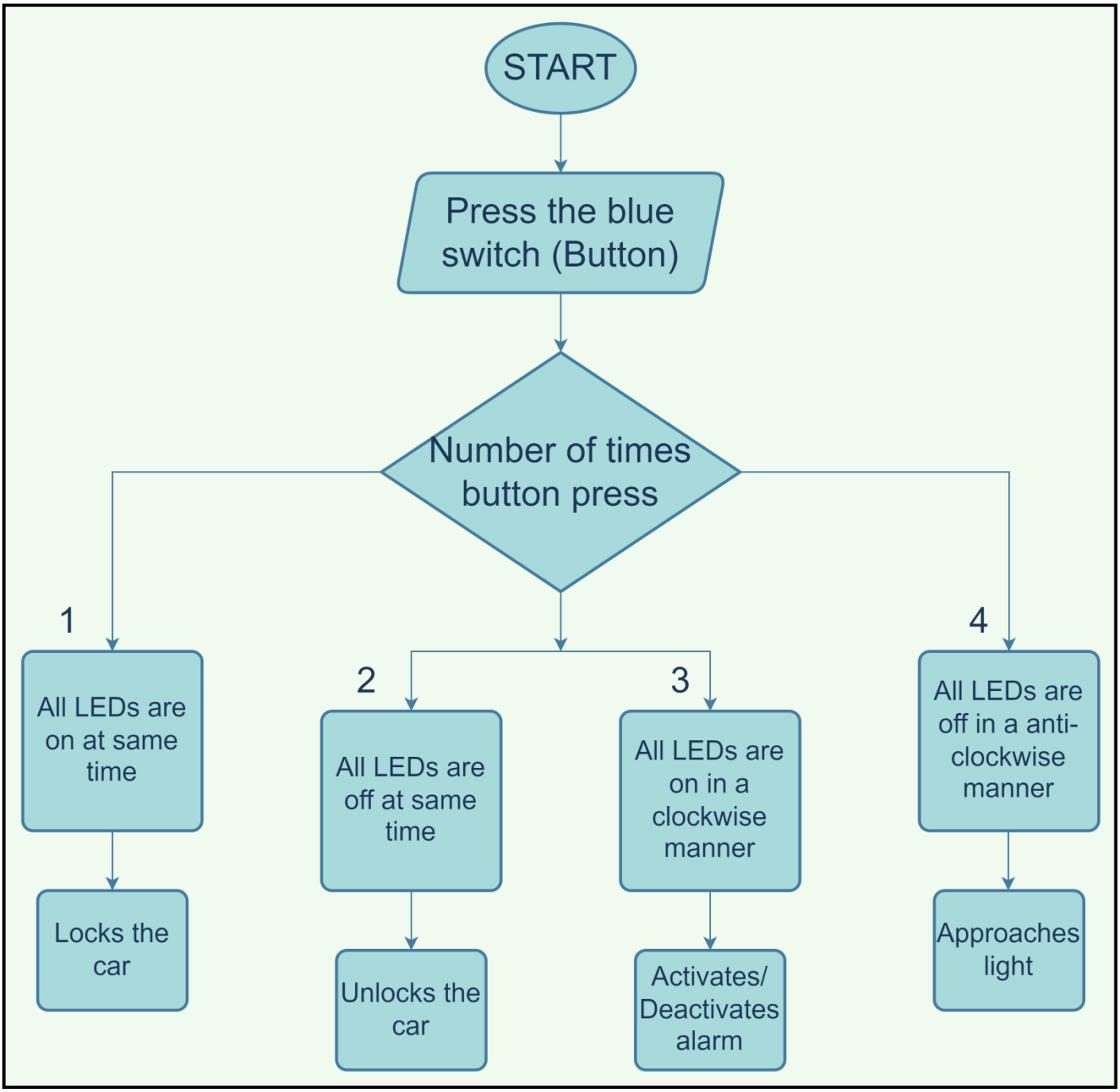
- *Bicom System:*

ID	Description	HLRID
LLR1.1	Vehicle must display the window status when blue switch is pressed once	HLR1.1
LLR1.2	All LEDs must turn on when blue switch is pressed once	HLR1.1
LLR1.3	Vehicle must display alarm status when blue switch is pressed twice	HLR1.2
LLR1.4	All LEDs must turn off when blue switch is pressed twice	HLR1.2
LLR1.5	Vehicle must display battery status when blue switch is pressed thrice	HLR1.3
LLR1.6	All LEDs must turn on in clockwise manner when blue switch is pressed thrice	HLR1.3
LLR1.7	Vehicle must display door status when blue switch is pressed four times	HLR1.4
LLR1.8	All LEDs must turn on in anti-clockwise manner when blue switch is four times	HLR1.4

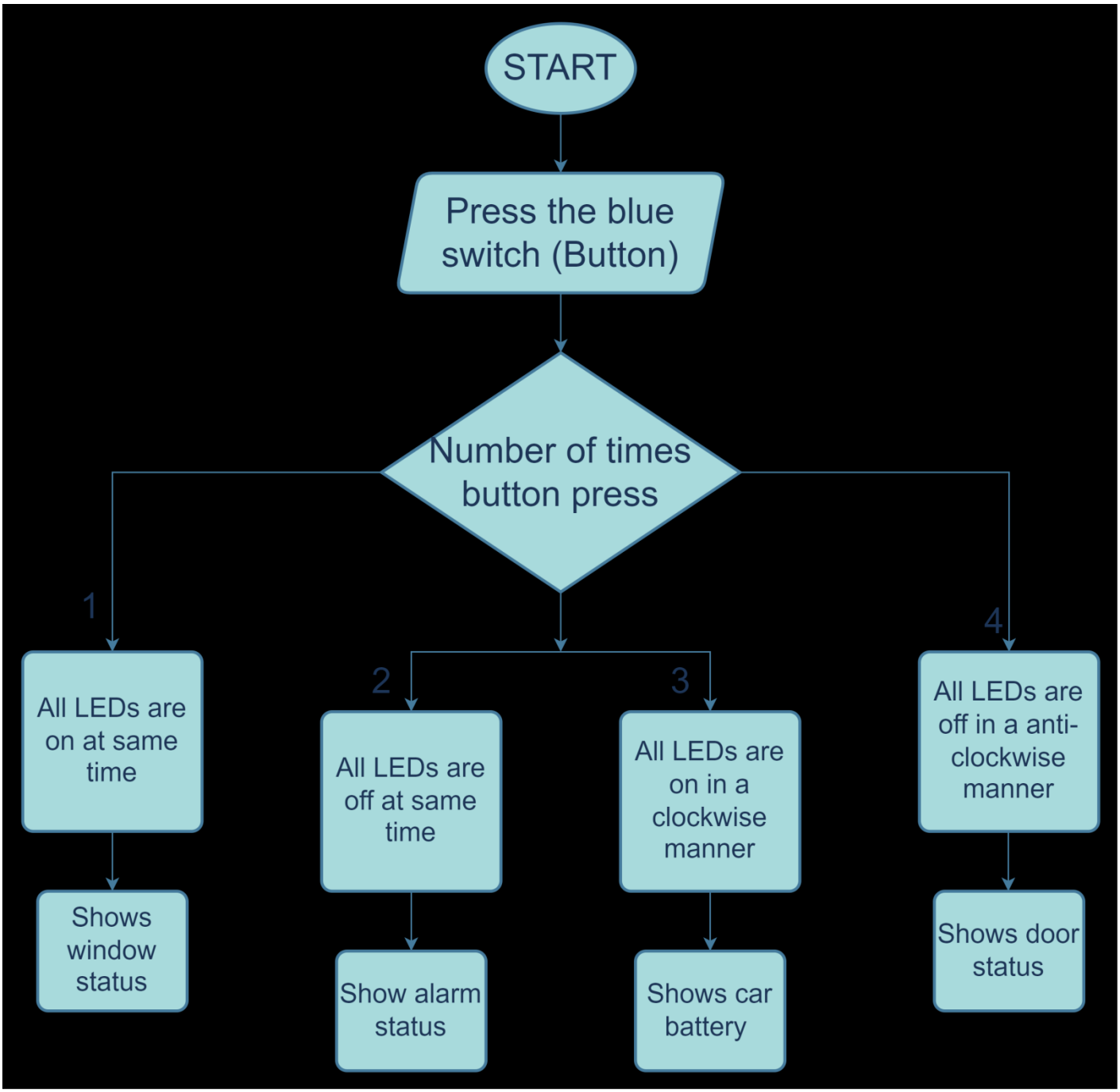
3. Architecture

a. Behavorial Diagram

- *Remote Keyless Entry:*

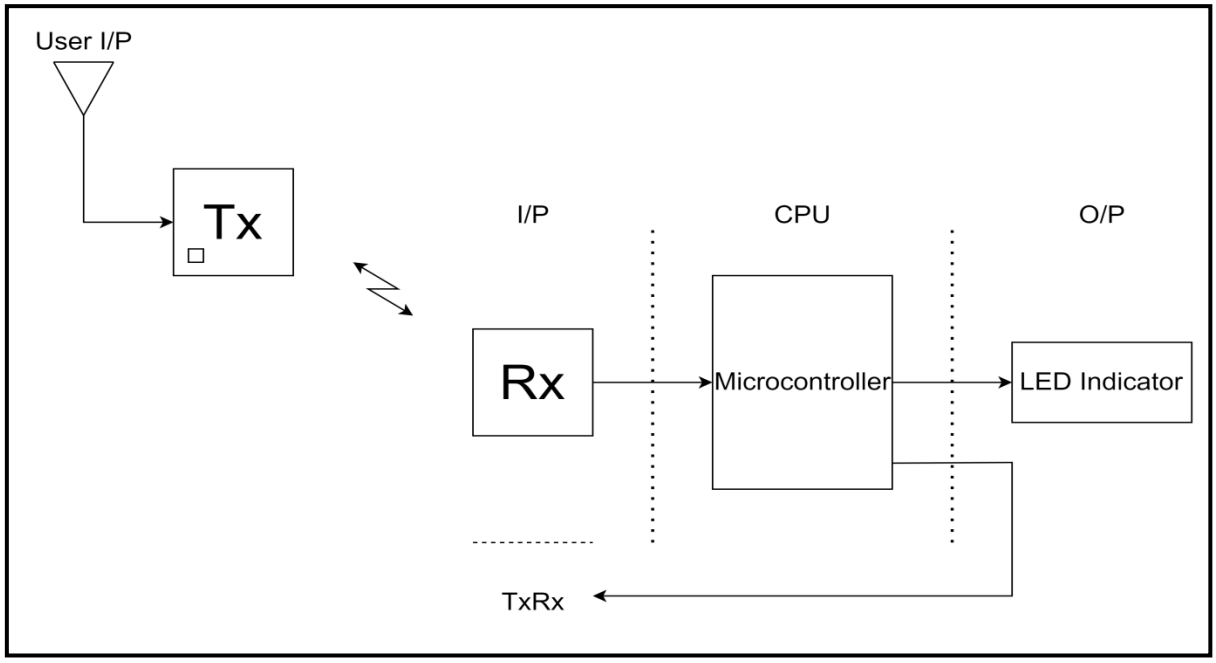


- *Bicom System:*

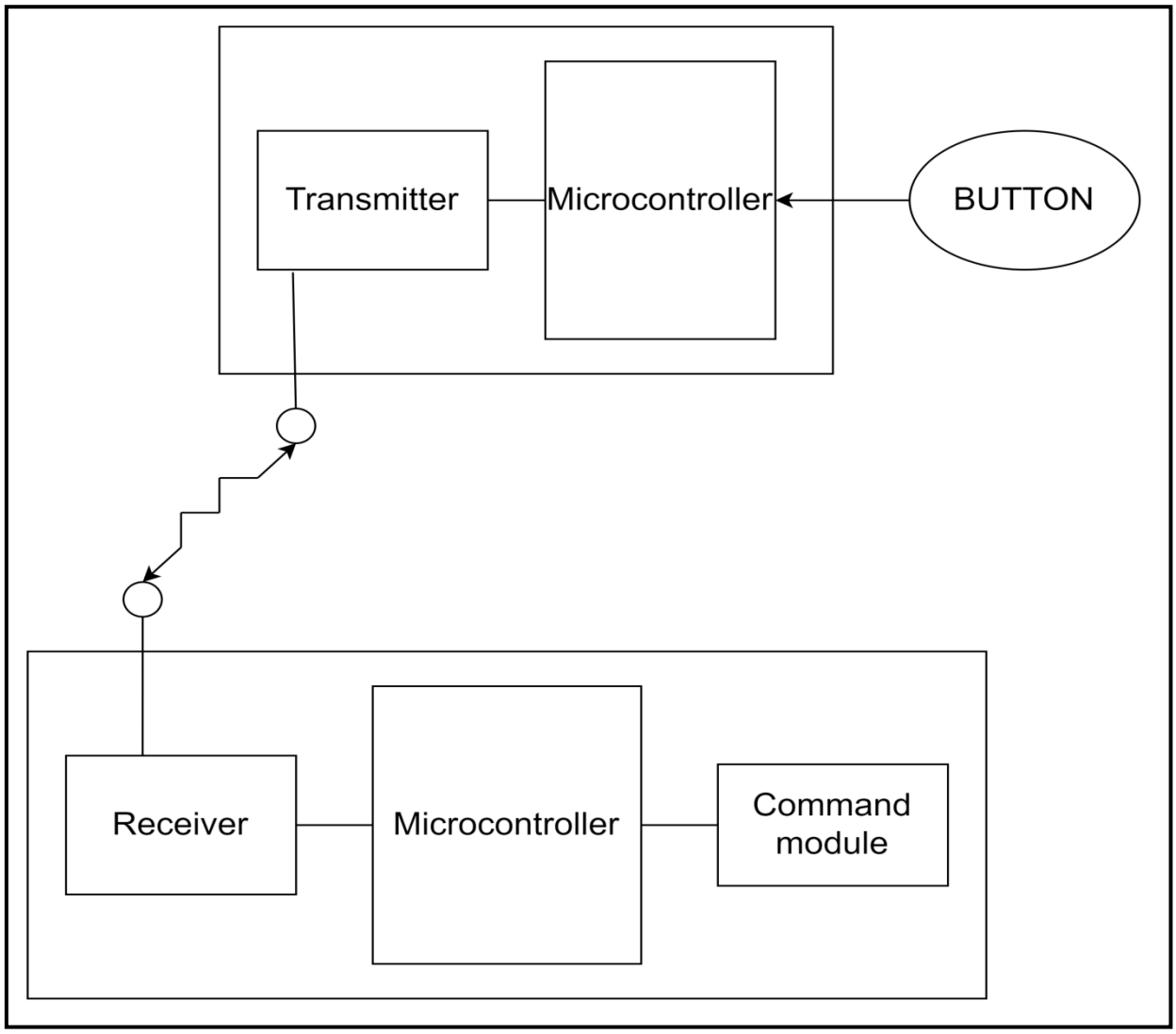


b. Structural Diagram

- *Remote Keyless Entry:*



- *Bicom System:*



4. **Test Plan**

a. High Level Test Plan

ID	Description	Input	Expected Output	Actual Output	Status
01	Button	Press it	LED_13 on	LED_13 on	☑
02	LED_12	Read pin	on	on	☑
03	All LED	Press Button	on	on	☑

b. Low Level Test Plan

ID	Description	Input	Expected Output	Actual Output	Status
01	Button	Press it	LED_13 on	LED_13 on	☑
02	Count 1	Press Button 1 time	All LED glow	All LED glow	☑
03	Count 2	Press Button 2 times	All LED off	All LED off	☑
04	Count 3	Press Button 3 times	All LED on clockwise	All LED on clockwise	☑
05	Count 2	Press Button 4 times	All LED on anticlockwise	All LED on anticlockwise	☑