Software Design Document

BLUETOOTH RC CAR WITH WI-FI CAMERA

Muhammed Said KAYA - 21627428

Mert ÇÖKELEK - 21727082

Index Terms-- Radio Controlling (RC), Bluetooth, Wireless Transmission, Android, Arduino

1. Introduction

a. Purpose

The purpose of the Software Design Description document is to be a guidance to the software development team about the overall architecture-build of the software project, written by software designers.

In detail, it covers the:

- design decisions
- constraints,
- design model,
- interfaces and the communications among them,
- revisioned structural and behavioral model of the software system

b. Scope

There are risks of losing personnel in the event of short-range military applications like getting caught by the enemy. With the advances in technology over the years, it is possible to remotely monitor areas of importance by using cars in place of humans. So , The software product is named RC CAR and will be controlled by an Android app using Bluetooth technology to support video surveillance in military scenarios. The benefits of this product are , humans do have their limitations, and deployment in inaccessible places is not always possible but by using this car can handle the security problems.

c. Definitions, Acronyms, and Abbreviations

Term / Acronym	Definition
BT	[1] Bluetooth is a wireless technology standard used for exchanging data between fixed and mobile devices over short distances using UHF radio waves in the industrial, scientific and medical radio bands, from 2.402 GHz to 2.480 GHz, and building personal area networks (PANs).
Wi-Fi	[2] Wifi is a family of wireless network protocols, based on the IEEE 802.11 family of standards, which are commonly used for local area networking of devices and Internet access.
RC Car	[3] RC cars are miniature model cars or trucks that can be controlled from a distance using a specialized transmitter or remote. The term "RC" has been used to mean both "remote controlled" and "radio controlled", where "remote controlled" includes vehicles that are controlled by radio, infrared or a physical wire connection (the latter is now obsolete).
Android OS	[4] Android is a mobile operating system based on a modified version of the Linux kernel and other open source software, designed primarily for touchscreen mobile devices such as smartphones and tablets. Android is developed by a consortium of developers known as the Open Handset Alliance and commercially sponsored by Google.
GUI	[5] Graphical User Interface (GUI) is a form of user interface that allows users to interact with electronic devices through graphical icons and audio indicators such as primary notation, instead of text-based user interfaces, typed command labels or text navigation.
Arduino	[6] Arduino is a microcontroller board based on the ATmega328P. It contains everything needed to support the microcontroller; simply connect it to a computer with a cable or power it with an AC-to-DC adapter or battery to get started.“ It can be upgraded with several integrations such as Wi-Fi and BT modules, motors, additional hardwares.

d. References

[1] Bluetooth- https://en.wikipedia.org/wiki/Bluetooth

[2] Wi-Fi- https://en.wikipedia.org/wiki/Wi-Fi

[3] RC Car- https://en.wikipedia.org/wiki/Radio-controlled_car

[4] Android OS- https://en.wikipedia.org/wiki/Android_(operating_system)

[5] GUI- https://en.wikipedia.org/wiki/Graphical_user_interface

[6] Arduino- https://store.arduino.cc/usa/arduino-uno-rev3

[7] Design Method- https://en.wikipedia.org/wiki/Structured_analysis_and_design_technique

e. Overview

The rest of the Software Design Document includes System Overview, and the brief summary of the components' communication with each other and also the system design that will be used in the development process. Next, the System Design section covers the design method, decomposition description of the system. Finally, the Component Description section covers a top-down description of the design components.

2. System Overview

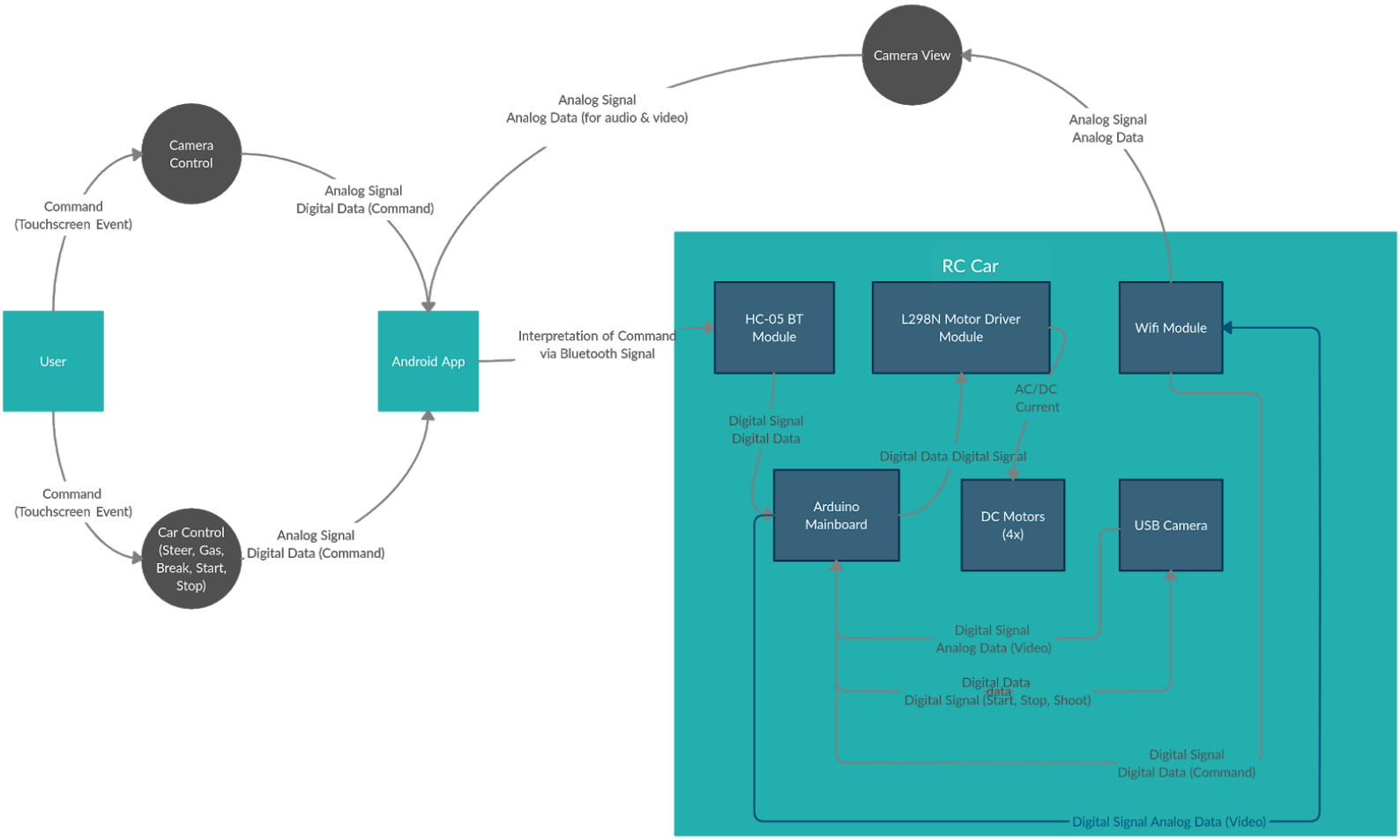
Via the Android application, forward, backward, right, left and turn on the camera commands, using bluetooth, a signal will be sent to the HC-05 Bluetooth module connected on the Arduino Uno single board computer. Then this module transmits the incoming signals to Arduino Uno. According to the content of the incoming command, signals are directed to the correct inputs of the L298N Engine Module. This engine module directs signals to 4 motors connected to it and the vehicle moves. For camera surveillance, data from the camera is sent to the android application using wifi technology.

3. System Design

a. Design method

Structured analysis and design technique (SADT) is a diagrammatic notation designed specifically to help people describe and understand systems.] It offers building blocks to represent entities and activities, and a variety of arrows to relate boxes. These boxes and arrows have an associated informal semantics.SADT can be used as a functional analysis tool of a given process, using successive levels of details. The SADT method not only allows one to define user needs for IT developments, which is often used in the industrial Information Systems, but also to explain and present an activity's manufacturing processes and procedures.The structured analysis and design technique uses a decomposition with the top-down approach. This decomposition is conducted only in the physical domain from an axiomatic design viewpoint. SADT uses two types of diagrams: activity models and data models. It uses arrows to build these diagrams.

b. Decomposition description as Data Flow Diagram



4. **Component Description** - A top-down description of the design components.

a. Android App

i. Type: Flutter (Hybrid)
ii. Purpose: Provides an Graphical User Interface to control remotely the car.
iii. Function: Start, Stop, Kill, Connect to Bluetooth Module.
iv. Subordinates: HC05-Bluetooth Module
v. Interfaces:
    1. In: Analog signal-analog data- Cell Phone
    2. Out: Analog signal-digital data- HC05 - ESP8266
vi. Data: None.

b. HC-05

i. Type: Bluetooth Module
ii. Purpose: Provides wireless one way synchronized transmission between cellphone and Arduino Uno single board computer
iii. Function: Turn On/Off , Connect
iv. Subordinates: Arduino UNO R3 6-pin slot
v. Interfaces
    1. In: Analog Signal- Digital Data- Android App
    2. Out: Digital Signal- Digital Data- Arduino UNO R3
vi. Data: None.

c. Arduino UNO R3

i. Type: Mainboard
ii. Purpose: Provides controlling the car remotely and the corresponding data-signal transmission, according to input commands.
iii. Function: Start, Stop, Steer, Gas, Break, Start Camera, Stop Camera.
iv. Subordinates
    1. L298N Motor Driver
    2. ESP8266 Wifi Module
v. Interfaces
    1. In: digital signal, digital data- HC-05 Bluetooth Module
    2. In-Out: digital signal, digital data- ESP8266 Wifi Module
    3. Out: digital signal, digital data L298N Motor Driver

d. L298N

i. Type: Motor Driver
ii. Purpose: Interface between the mainboard and the DC motors
iii. Function: Start, Stop.
iv. Subordinates
    1. DC Motors(x4)
v. Interfaces :
    1. In: Digital Signal from mainboard
    2. Out: DC current to the motors
vi. Data: None.

e. Goldmaster V-2 Webcam

i. Type: USB Device
ii. Purpose: Provide visual data(Analog Signal) as Digital Signal
iii. Function: Start-Stop trailing.
iv. Subordinates: USB Slot of Arduino UNO
v. Dependencies: None
vi. Interfaces:

In: DC current, digital signal.

Out: Analog data, digital signal.

vii. Data- Video, image and audio data.

f. ESP8266

i. Type: Wifi Module
ii. Purpose: Provide wireless connection (Wi-Fi) between the mainboard and the environment
iii. Function: Turn on, Turn off, Connect
iv. Subordinates: Corresponding slot in mainboard.
v. Dependencies: None
vi. Interfaces:
    1. In: Analog signal, digital data- Android App
    2. Out: Analog signal, analog data- Android App
    3. Out: Digital signal, digital data- Arduino UNO R3
vii. Data: None.