MAKERERE UNIVERSITY

COLLEGE OF COMPUTING AND INFORMATION SCIENCE

SCHOOL OF COMPUTING AND INFORMATICS TECHNOLOGY

COURSE: BSE 4100 SOTWARE ENGINEERING PROJECT I

PROJECT TITLE: ETHANOL DETECTION IN HUMAN DERMAL SKIN LAYER USING NON-DISPERSIVE INFRARED SPECTROSCOPY

PROJECT BLOG: https://ethanoldetection.home.blog

SOFTWARE REQUIREMENTS SPECIFICATION

GROUP MEMBERS

NAME	REGISTRATION NUMBER	STUDENT NUMBER	EMAIL	SIGNATURE
YIGA MARK GABRIEL	16/U/12433/EVE	216006690	yigamarkgabriel333@gmail.com	
GAVOOLA JUMA	16/U/4817/EVE	216012520	Jgavoola95@gmail.com	
CHRISTOPHER MWAKA NWANG	16/U/20001/EVE	216021559	chrisnwang56@gmail,com	
KEEYA EMMANUEL LUBOWA	16/U/5843/EVE	216006992	keeyaemmanuel12@gmail.com	

……. SUPERVISOR

Software Requirements Specification

for

ETHANOL DETECTION IN HUMAN DERMAL SKIN LAYER USING NON-DISPERSIVE INFRARED SPECTROSCOPY

Version 1.0 approved

Prepared by BSE 2019

DEPARTMENT OF NETWORKS

12/10/2019

Table of Contents

Revision History.

Name	Date	Reason For Changes	Version

1 Introduction

1.1 Purpose

This document is a software requirements specification that is aimed at developing an ethanol detection software system in the human dermal skin layer using (NDIR)Non-Dispersive Infrared Spectroscopy [1].

This document is also aimed at acting as a communication medium through feedback between the customer and the software developer by ensuring confidence that the functionality that has been detailed will be actually substantiated.

This document is also aimed at breaking down the requirements of the system which entails basically the functional and the non-functional requirements. This document is structured in such a way that it breaks the deliverables into smaller components which makes the participants in this project to understand what is to be done clearly.

The information is organized in such a way that all the developers within the team will not only understand the boundaries within which we need to work but also what functionality needs to be developed and in what order.

Understanding what order the functionality will be developed means that we, the developers will have the "big picture" view of the development. This gives us an opportunity to plan ahead which saves both project time and cost.

This document also is aimed at facilitating other documentation in that it forms the basis for a load of other important documents such as the Software Design Specification.

Lastly, this document will be used for product validation since it basically helps in validating with the client that the product which is being delivered, meets what they asked for. This means that the product we have output is Equal to the standards of the documentation in the SRS which the client satisfied and agreed on.

1.2 Document Conventions

The document is prepared using Microsoft Word 2016 and has used the font type 'Times New Roman'. The fixed font size that has been used to type this document is 12pt with 1.5-line spacing. It has used the bold property to set the headings of the document.

All pages except the cover page are numbered, the numbers appear on the lower right-hand corner of the page. Every image and data table is numbered and referred to in the main text.

Standard IEEE template is the template used to organize the appearance of the document and its flow. We also made use of the IEEE referencing style and Mendeley so as to add the required references to the document [2].

.

1.3 Intended Audience and Reading Suggestions.

The intended audience of this document would be the clients such as the car developers, car owners, the security operatives, researchers and other software developers with the objective of ensuring the safety of the lives of the people that make use of transport means especially vehicles. The SRS document can be used in any case regarding the requirements of the project for example by tracking down the requirements of the system and the solutions that have been taken. The document would be of help by providing a clear idea about the system that is being developed.

1.4 Product Scope

Currently there are many road accidents especially during the festive seasons that are being reported regularly which are majorly caused by drunk driving or by having very high alcoholic levels in the human body due to excessive drinking of alcoholic drinks as stated by New Vision [3].

Due to its psychoactive effect of alcohol or ethanol in the human body or blood, car drivers should not use it as just before they drive, the commonest measure currently in place for detecting it includes a victim blowing just the right amount of breath in an alcohol breathalyzer.

This method though takes a bit longer and its inconveniencing, it also relies on the fact that the test subject provides the right amount of breath, and according to their lung capacity, and henceforth we sometimes end up with wrong results, in addition to making sure someone unbiased is around to do the test.

What if there was a way where your car engine does not start not until you are cleared that you are ethanol-free, this can be archived using NIR spectroscopy as described below.

Near-Infrared Spectroscopy is one of the most frequently used optical techniques used for detecting the presence of organic compounds in chemical substances. There is a very interesting behavior when an infrared ray of light is passed through a substance containing a hydrocarbon, a hydrocarbon a chemical compound composed of at least carbon and Hydrogen, and luckily enough, ethanol is one of them as clearly evident through its chemical equation CH3CH2OH.

Alcohol is an important substance in organic chemistry that may be amended from many other types of compounds. Ethanol or ethyl alcohol CH3CH2OH is a compound that can be found in alcoholic beverages.

One method of detecting and measuring alcohol is Non-Dispersive Infrared. NDIR is a spectroscopy method commonly used to detect gas, for example, CO or CO2. It is called as non-dispersive because this method lets through all infrared wavelengths with particular intensity through a sample tube without deformation. NDIR has an advantage of simplicity in design and cheap in price.

The system will make use of the principle that is based on the Beer-Lambert, which dictates that when monochromatic light passes through a medium (solution), then some light is absorbed, some light partially reflected, and some light partly transmitted. So the transmittance is the ratio of the transmitted light intensity when passing through the sample with a first light intensity before passing through the sample**.**

So with the above theory, we can measure the amount of alcohol in one's blood basing on how much infrared is absorbed, we shall calibrate our devices as per infrared through distilled water and also, we shall compare our results to the available breathalyzer test to look out for patterns.

Hence, the amount of transmitted light or reflected light shall trigger a corresponding voltage in a device known as microcontroller hence we shall use that to tell the intensity of light that has been reflected or transmitted through.

1.5 References

[1] Heyendaalseweg, "Optical Infrared Spectoscopy," 2019. [Online]. Available: https://www.ru.nl/systemschemistry/equipment/optical-spectroscopy/infrared/.

[2] S. Lauesen, "Task Descriptions as Functional Requirements, IEEE Computer Society,," 2003. [Online]. Available: http://www.itu.dk/~slauesen/Papers/IEEEtasks.pdf.

[3] N. Vision, "police start day time kawunyemu operations," 30 04 2015. [Online]. Available: https://www.newvision.co.ug/new_vision/news/1325054/police-start-daytime-kawunyemu-operations.

[4] 27222, "atmega16 pin diagram 3," 1 06 2017. [Online]. Available: https://electronicsforu.com/resources/learn-electronics/atmega16-pin-diagram-3.

[5] Headbomb, "System bus," 2005. [Online]. Available: https://en.m.wikipedia.org/wiki/System_bus.

[6] Jayant, "GSM module," 05 08 2015. [Online]. Available: https://circuitdigest.com/microcontroller-projects/gsm-module-interfacing-with-8051-at89s52.

[7] DIAGEO, "why drink driving is so dangerous," 2019. [Online]. Available: https://www.drinkiq.com/en-ke/how-alcohol-affects-us/when-alcohol-is-dangerous/why-drink-driving-is-so-dangerous/.

[8] UBL, "drink driving campaigns," 2019. [Online]. Available: https://www.ugandabreweries.com/sustainability/alcohol-society/drink-driving-campaigns.

[9] M. Joseph Kimuli, "Road traffic accidents in Uganda," 2019. [Online]. Available: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5279989/.

[10] A. Gitta, "kawunyemu app warns ugandas drink drivers of police checks," 2019. [Online]. Available: https://www.google.com/amp/s/amp.dw.com/en/kawunyemu-app-warns-ugandas-drink-drivers-of-police-checks/a-36401348.

2 Overall Description

2.1 Product Perspective

Most of the cars in Uganda don't have any form of functionality of detecting ethanol/alcohol content of drivers before setting off. The major form of detecting alcohol content is by use of an ethanol breathalyzer; however, this method is only performed only when a security or traffic officer encounters a specific car driver at specific times or occasions but unfortunately this form of detection is done at a rare basis.

Henceforth, this entices the drivers to take advantage of loopholes in the traffic monitoring system as regards eradicating the vice of drunk driving, hence, therefore, risking their lives and property and also the lives and properties of other road users.

The proposed ethanol detection software system will help eliminate the vice of drunk driving through the detection of the ethanol content in the bodies of the drivers of the different vehicles before taking off and also alerting the responsible authorities.

The usage of the Infrared light to detect and be able to measure alcohol content in the human body will be helpful by shutting down the car engine system as soon as a high-level of alcohol content is ascertained by the system. This will help save a lot of lives and property that may be destroyed by accidents caused by drunk driving.

BLOCK DIAGRAM FOR THE SYSTEM

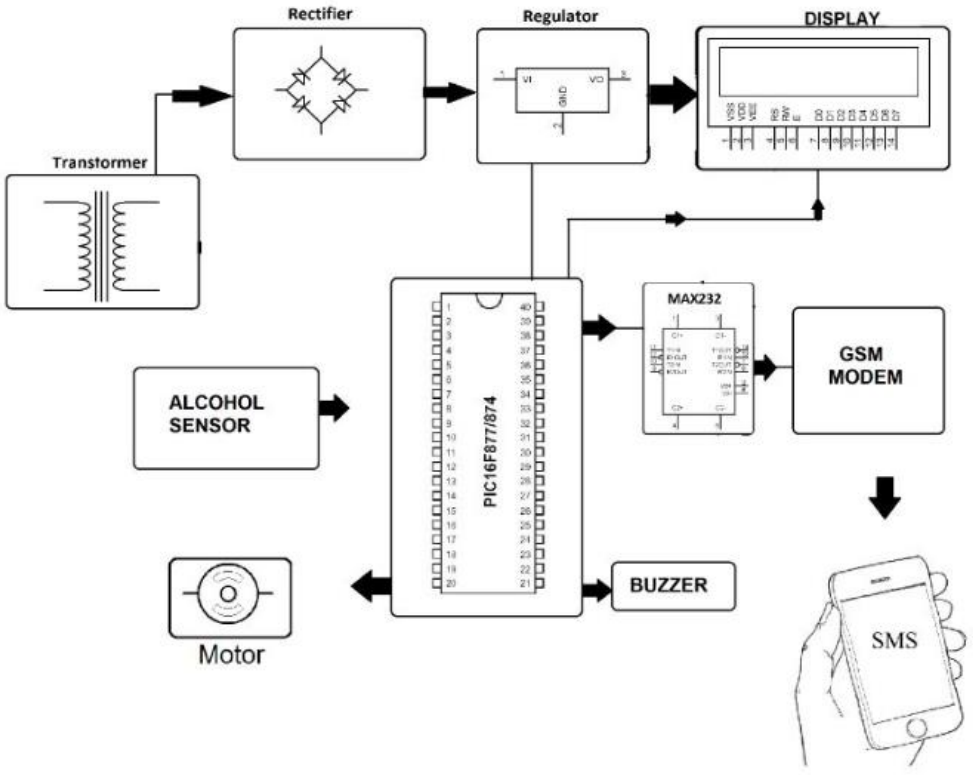

Figure 2-1 Block Diagram of the System

2.2 Product Functions

Detect ethanol. This function entails the emitting the infrared red rays towards the system user, and then determine the alcohol levels in the body using the intensity of the infrared rays that are reflected from the user's body.

Register the user's contact number. This will involve recording the phone number of the person in charge so that it can be used by the GSM module to notify him or her of any information that comes up.

Display results. Here the results of the alcohol test will be displayed to the user of the system on the LCD display, and also will be sent to the phone number that will be registered in the system.

Issue warning. Depending on the outcomes of the alcohol detection test, the system will alert the user of the driver of the car through the use of LED and the buzzer.

- For the LED; it will either light green for positive results or light red for negative results.
- For the buzzer; it will either make one beep for positive results or make beeps until the system is shut down.

Send SMS. The system will also send an SMS notification to the user or the person-in-charge of the of a particular car. The SMS will only be sent in case a high level of alcohol content is detected in the user's or the driver's body.

Continuous Detection. This function will enable the system to run every after a specified time period so as to continuously check the alcohol content levels in the driver's body and then perform the corresponding functions depending on the results.

Complete power supply to the engine. The function will complete the car engine execution by completing the circuit in case the alcohol detection test is passed by the user or driver of the car.

Break power supply to the engine. This function will break the car engine execution by breaking the circuit in case the alcohol detection test is failed by the user or driver of the car.

2.3 User Classes and Characteristics

Car Manufacturers

These are the firms or organizations that are responsible for the production of vehicles, especially cars and their respective accessories and devices.

Key Functions

- They produce the car.
- They integrate the individual system components
- They specify and select the requirements suitable for a given car system to operate.
- They test the system features to ensure they operate as expected.

Car consumer Organizations

These are the firms or organizations that make use of car or transport services by purchasing a specific brand and type of cars that support their business activities.

Key Functions

- They specify the type of cars needed to accomplish their business activities.
- They specify the functions and features of the car systems they want.
- They own the purchased cars and satisfy the necessary car information.
- They give out the cars to the drivers and or employees of the company.
- They monitor the reports received from the alcohol detection systems from the company cars.
- They also monitor and are responsible for the welfare of the car and the individual system components.

Car Driver or Car Owner

This can either be the person who is responsible for driving a given car or the person whom own the car and hence has access and take any important decisions concerning it.

Key Functions

- Operates the car systems.
- Undergoes the alcohol detection test.
- Ensures that he or she is alcohol-free in order to drive the car
- Reads the values presented in case of the presence of alcohol in the body.
- Is answerable to the notifications and messages pertaining drink driving
- Reports any failures as regards the correct operation of the system

2.4 Operating Environment

Software Requirements

- Operating system – windows 10 for development
- C language compiler

Hardware Requirements

- Micro Controller
- LCD Display
- RAM
- ROM
- infrared sources
- A sample tube
- infrared detector
- Power Supply
- GSM module

Human requirements

- Fingers
- Blood molecules

2.5 Design and Implementation Constraints

For the design constraints;

- The system core should have a fast interrupt response.
- The microprocessor should be of very high performance.
- The system will be developed using either the python or C programming languages.
- The system should be very reactive.
- The infrared emitter should emit up to v= 3620cm-1 that is like 2.7nm.

For the implementation constraints;

- The user of the system should not possess any form of allergic reactions to infrared light.
- The system needs a regular supply of power.
- The system should be so fast and reliable.
- The system should use less RAM to perform computations.
- The user of the system should not possess any form of allergic reactions to infrared light.
- The human skin contains other hydrocarbons which may make our already fragile error worse.
- Only a user that has access to the software system within an acceptable range of distance can be able to make use of the system.
- Systems that adopt the IR technology are larger in size therefore it will be difficult to incorporate the system into steering.

2.6 User Documentation

As a part of the system, user documentation is provided to the customers which give an overview of the system. It will include the full description of the product and complete orderly followed steps to install the software. The users will get the opportunity to use the system without having any trouble.

The user manual will include the email addresses to contact us in need. Tasks are listed alphabetically or logically grouped often using cross-referenced indexes which helps the users to know exactly what sort of information they are looking for.

Table 2-1 Contains further project documentation that will be provided to the user

Software Life Cycle Phase	Documentation	Intended Activities
Requirement Gathering, Analysis and Specification.	• Research Concept Paper • Data Collection Tool	Includes the customer expected software features,

	• System Requirement Specification(SRS) which includes; ✓ Use case Diagram ✓ Data Flow Diagrams ✓ Use case Scenarios	constraints, interfaces and other attributes. Moreover the objectives and the benefits gained through the system are clearly specified
System Design.	• System Design Document(SDD)	Describes the logical basis of design decisions taken and how it will pave way in acquiring the requirements of the customer through the software.
Implementation	• Technical Documentation	Contains information regarding the implementations of the system using the programming concepts
Software Testing	• Software Test Documentation(STD)	Includes information degrading testing procedures to validate and verify the software results. Main types of testing techniques are unit testing, integration testing, system testing and acceptance testing.
Maintenance	• User Documentation	Includes manuals for the end users according to their position of access levels.

2.7 Assumptions and Dependencies

- The system should be switched on as long as there is power supply.
- The system runs every after a given time period.
- The user should not be wearing any sort of protective gears from infrared red.
- The user of the system must be an abled person with hands with fingers
- The user of the system is not affected by the infrared rays such as in terms of any sort of allergies.
- The amount of transmitted light or reflected light shall trigger a corresponding voltage in our microcontroller of the system.
- The voltage will be used to tell the intensity of light that that has either reflected or transmitted through the body.
- The user of the system must be able to interpret the values which are the results of the system.

3 External Interface Requirements

3.1 User interfaces

Figure 3-1: User interfaces for the graphical LCD Display

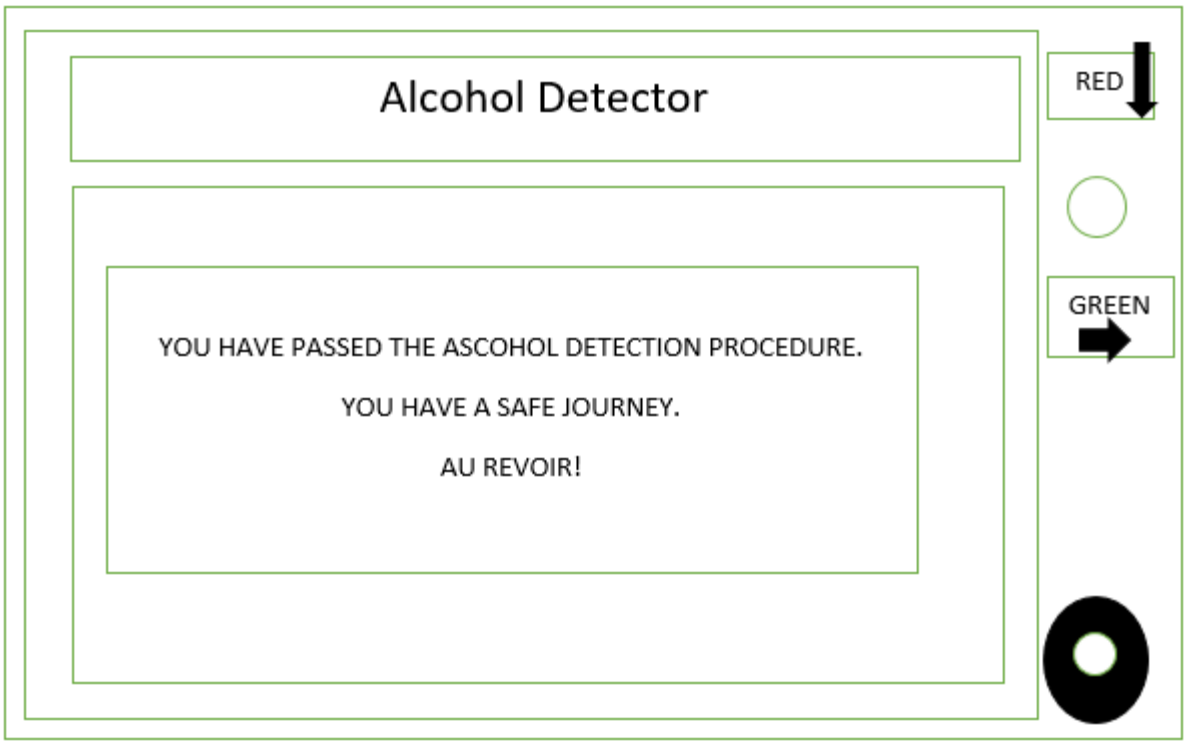

Figure 3-2: User interfaces for the graphical LCD Display

3.2 Hardware Interfaces

- Buzzer.

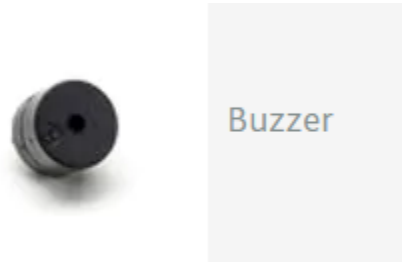

Figure 3-3: This makes a sound or an alarm so as to notify the user in case alcohol has been detected in his body.

- LED(Red).

Figure 3-4: The red semiconductor diode(LED) that will inform the user that alcohol has been detected and that he or she cannot drive.

- LED(Green).

Figure 3-5 : The semiconductor diode(LED) that will inform the user that he or she passed the alcohol detection test.

- LCD Display.

Figure 3-6 : The LCD Display that will be used to display the results of the alcohol detection.

- Spectroscopy Sensor.

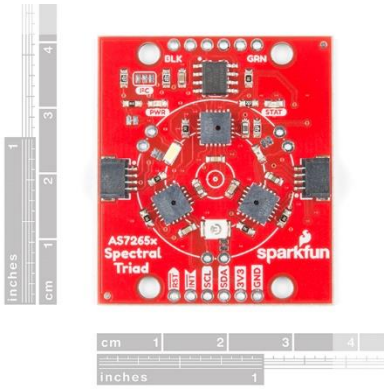

Figure 3-7: The Spark-Fun Triad spectroscopy sensor is a powerful optical inspection sensor also known as a spectrophotometer

Three AS7265x spectral sensors are combined alongside a visible, UV and IR LEDs to illuminate and test various surfaces for light spectroscopy. The Triad is made up of three sensors: the AS72651, the AS72652, and the AS72653 and can detect the light from 410nm(UV) to 940nm(IR).

- Atmega16 [4].

Figure 3-8 : ATMega16 Microcontroller

- DC Motor.

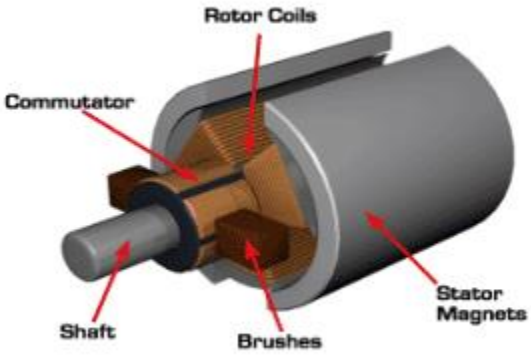

Figure 3-9: The DC motor that will represent the engine of the car in that it will run if there is no alcohol content detected in the body.

- GSM Module.

Figure 3-10 : The GSM module that is responsible for sending messages to already registered members.

3.3 Software Interfaces

- Developing End
  - ✓ C or Python Compiler / Interpreter
  - ✓ GSM Technology for notifying the subject and other relevant bodies of the discovery.
- Client End
- LCD display for presentation of results

3.4 Communication Interfaces

- Data bus.

These facilitate the flow of data and instructions within the system such that given components can perform the specified functions [5].

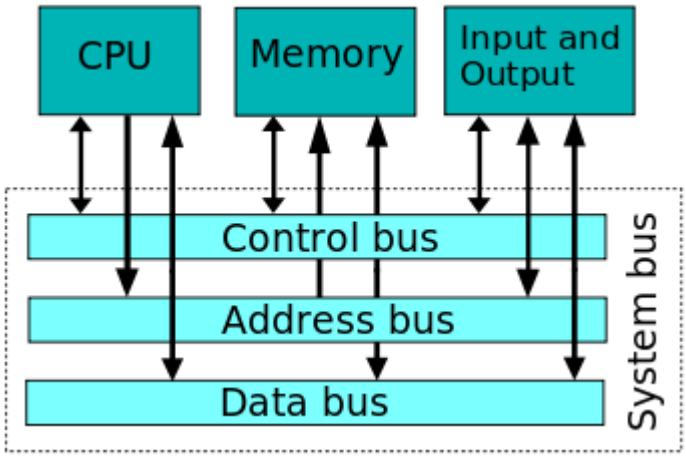

Figure 3-11 Data Bus

- GSM Module [6].

  This module will be used for sending alert messages to the registered numbers of the operatives of the car in the system.

  The figure for the GSM Module is shown the figure above.

- Infrared light.

  When this light passes through a medium or the body, some of the light is absorbed, and then also partially reflected, and partly transmitted. So this amount of infrared absorbed will be use to ascertain values by making use of the reflected light.

Figure 3-12 A sample of an infrared emitter.

4 System Features

4.1 User Registration

4.1.1 Description and Priority

This feature will entail registering the phone number of the person responsible for the car which will be used by the GSM module to send a message alerting him or her of the high alcohol content detected.

4.1.2 Stimulus/Response Sequences

Purchasing the car will henceforth require the registration since the car will not be driven unless the system is operational.

Activating the system so as to be able to carry out the alcohol detection for the first time will enforce the registration.

The desire or the need to update the phone number of the person in charge or the car will stimulate this feature.

Response

The user will receive notification messages regarding the alcohol content levels detected.

4.1.3 Functional Requirements

FR001: The system shall register the phone number of the person in charge of the car.

FR002: The system shall notify the car driver or owner upon successful registration.

4.2 Infrared Emission

4.2.1 Description and Priority

This will involve the infrared spectrometer emitting infrared rays towards the body or specifically the hands of the driver of the car so that they penetrate his or her body to enable alcohol detection.

4.2.2 Stimulus/Response Sequences

Stimulus

The power supply to the system will make the emitter to emit the rays.

Also the issuing of a command by the system to perform the alcohol detection test after given time intervals.

Response

The infrared spectrometer will emit the light rays for a specified time period.

4.2.3 Functional Requirements

FR003: The system shall emit infrared light rays towards the body of the driver.

4.3 Alcohol Level Detection

4.3.1 Description and Priority

This will involve the system processing the level of alcohol content in the human body by making use of the intensity of the reflected light rays from the human body.

4.3.2 Stimulus/Response Sequences

Stimulus

This feature will be stimulated by the reflected infrared light rays from the human body.

Response

The user is notified about the results of the test performed.

4.3.3 Functional Requirements

FR004: The system shall detect the alcohol content in the human body.

4.4 Car Engine Management

4.4.1 Car Engine Management

This feature involves having the car engine circuit either being broken or executed depending on the results of alcohol levels or percentage detected by the system.

4.4.2 Stimulus/Response Sequences

Stimulus

This feature is stimulated depending on the results of the alcohol detection test performed.

Response

The driver will either be given the clearance to drive or not.

4.4.3 Functional Requirements

FR005: The system shall complete the circuit for the car to take off if the driver passes the alcohol detection test.

FR006: The system shall break the execution of taking off of the car if it detects a high ethanol percentage.

4.5 User Notification

4.5.1 Description and Priority

The user notification involves ways of informing and alerting the user of the result of the alcohol detection test that has been performed on the driver's body.

4.5.2 Stimulus/Response Sequences

Stimulus

This feature is stimulated incase the system will detect a high alcohol content the body of the driver of the system's user.

Response

The user of the system is alerted of any developments or the results from the alcohol detection test.

4.5.3 Functional Requirements

FR007: The system shall display information on the LCD Screen pertaining the results of the alcohol detection.

FR008: The system shall make an alarm to notify the user in case the alcohol has been detected.

FR009: The system shall display a blinking light to notify the user of the status of the alcohol content in the blood.

FR010: The system shall notify the user when it is going to break the circuit.

FR011: The system shall send an SMS notification to the preregistered numbers in case alcohol has been detected in a victim.

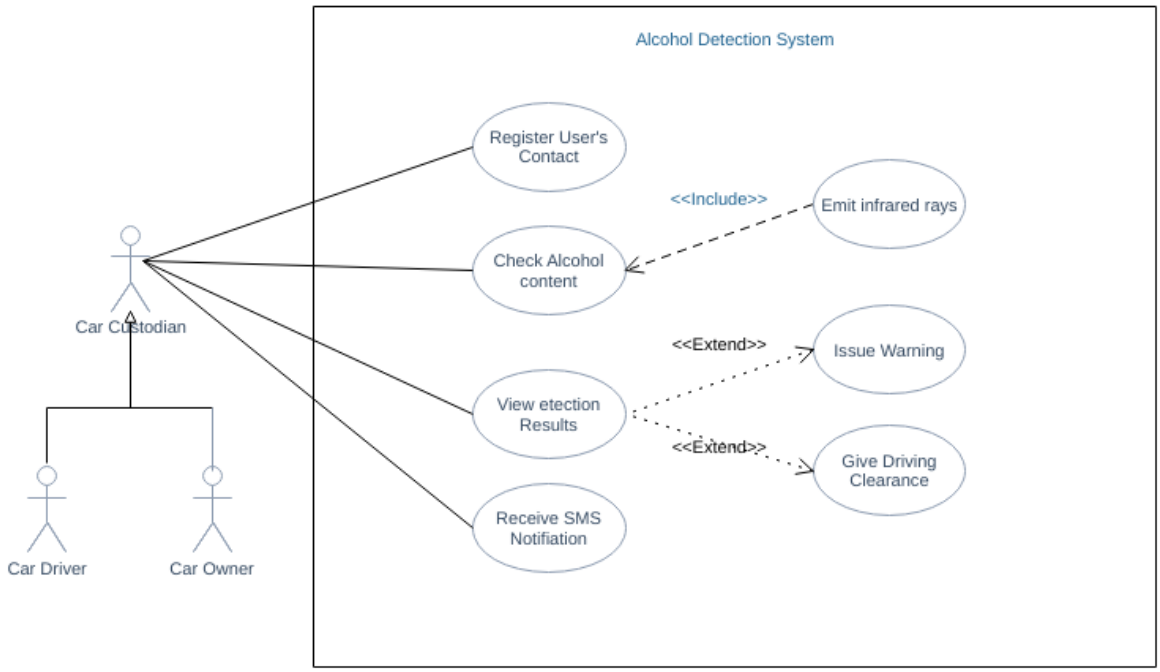

Figure 4-1 Use case diagram showing system functions.

Use Case: Register User's Contact
ID: UC001
Brief Description: This involves registering the contacts of the people responsible for the car so that they can used by the GSM module to notify them through SMS
Primary Actors: Car Driver Car Owner
Secondary Actors: Traffic officers
Pre-Conditions: The GSM module should be already deployed in the system.
Main Flow: 1. The car is purchased by given individual/ organization 2. The car system is activated by the system specialist. 3. The system specialist records the phone number of the car owner or the driver into the system
Post Conditions: The user's phone number is recorded and saved in the system
Alternative Flow:

None

Table 4-1 Use case specification for Register User's Contact

Use Case: Check Alcohol Content
ID: UC002
Brief Description: The system checks for the percentage of alcohol in the driver of a car
Primary Actors: Car Driver
Secondary Actors: Any other person trying to check for alcohol content in his/her body.
Pre-Conditions: The Infrared spectrometer should capable be emitting infrared rays. The system user should position his fingers in the direction of the infrared rays emitted.
Main Flow: 1) The driver or any other user of the car starts the car. 2) Then puts the fingers or hands towards the infrared emitter. 3) Then waits for a notification
Post Conditions: The system completes the circuit for the car to pursue driving. The driver receives a notification.
Alternative Flow. None

Table 4-2Use case Specification for Check Alcohol Content

Use Case: View Detection Results
ID: UC003
Brief Description: The driver or person/form responsible for the car receives a notification
Primary Actors: Driver Car owner
Secondary Actors: Car owner Traffic officers
Pre-Conditions: The driver or user should have subjected him or herself to the infrared rays. The system should have already registered numbers of the users.
Main Flow: 1) The system emits infrared rays to the body of the driver or intended person. 2) The system computes the results. 3) The system prints the results on the LCD screen. 4) The system notifies the driver upon completion 5) The system send s an SMS to the registered contacts entailing the results.
Post Conditions:

The driver sets off The system breaks off the engine
Alternative Flow: None

Table 4-3 Use case specification for View Detection Results

Use Case: Receive SMS Notification
ID: UC003
Brief Description: The GSM module sends an SMS to the already preregistered number of the user notifying him or her of the alcohol content detected
Primary Actors: Driver
Secondary Actors: Car owner
Pre-Conditions: The number of the person responsible for a given car is already registered. The GSM module feature is already activated and fully functional.
Main Flow: 1. The emitter emits infrared rays towards the driver. 2. The system then calculates the alcohol percentage in the driver's body. 3. If a high alcohol content is detected in the body 3.1.The system sends an SMS to the preregistered number 4. Else 4.1.The system continues with the execution of the car engine.
Post Conditions: The user or driver receives an SMS
Alternative Flow: User's account not available or active at a given time.

Table 4-4 Use case Specification for Receive SMS Notification

Alternative Flow :Receive SMS Notification: User's account not available or active at a given time.
ID:UC0001
Brief Description: This is where the GSM module sends a SMS to number that is disabled or which is inactive for a given time period.
Primary Actors: Driver
Secondary Actors: Any other preregistered users
Pre-Conditions: The registered user is unavailable to receive the SMS notification

Main Flow: 1. The SMS module sends a message to the preregistered number 2. If the message fails to go the prescribed number 2.1.Notify the driver about the message sending failure to a given number 2.2.Send message to any other registered number 3. Else 3.1.Rely on the sound made by the buzzer and also the red light emitted by semi-conductor diode.
Post Conditions: None

Table 4-5 Use case Specification for Receive SMS Notification: User's account not available or active at a given time.

Use Case: Emit infrared rays
ID: UC003
Brief Description: This is where the infrared spectrometer emits infrared rays towards the body of the driver
Primary Actors: Driver
Secondary Actors: Any other person who has interest in checking for alcohol content in his body.
Pre-Conditions: The system should be functioning properly. There should be adequate power supply to the system.
Main Flow: 1. The system is switched on. 2. The driver/users puts his or her hands near the infrared emitter. 3. The infrared Spectrometer emits the infrared light rays.
Post Conditions: The system detects alcohol content using the reflected light rays
Alternative Flow: None

Table 4-6 Use case Specification Emit infrared rays

Use Case: Issue Warning
ID: UC003
Brief Description: This involves alerting the driver about a high alcohol content in his or her body through sound made by the buzzer and light emitted by the LED
Primary Actors: Driver
Secondary Actors: None
Pre-Conditions: The system should have detected a high alcohol content in the driver's body

Main Flow: 1. The system checks for the alcohol percentage in the driver's body. 2. If the system detects a high alcohol percentage 2.1.The buzzer makes a sound for some seconds 2.2.The semi-conductor diode lights with a red color 3. Else 3.1.A message is displayed on the screen informing of the successful passing of the test. 3.2.The semi-conductor diode light with a green color
Post Conditions: The system engine is blocked from executing any further so as to facilitate driving. The driver upon receiving a green light continues to drive.
Alternative Flow. None

Table 4-7 Use case Specification for Issue Warning

Use Case: Give Driving Clearance
ID: UC003
Brief Description: This involves the driver or user of the system passing the alcohol detection test and then given a clearance to drive.
Primary Actors: Driver
Secondary Actors: None
Pre-Conditions: The system should have detected a low ethanol percentage in the driver's body
Main Flow: 1. While there is power supply to the system 1.1.The system checks for the alcohol content in the driver's body. 1.1.1. If the system detects a high alcohol content 1.1.1.1.The notifies the driver or any other system user of the results of the test 1.1.1.2.If the driver is already driving 1.1.1.2.1. The system notifies the driver that it's going to disable the driving capability of the car. 1.1.1.3.Else 1.1.1.3.1. The system does not complete the circuit by cutting supply of fuel to the engine 1.1.2. Else 1.1.2.1.1. The system does not complete the circuit by cutting supply of fuel to the engine
Post Conditions: The system affects the execution of the car engine by either turning it on or off
Alternative Flow None

Table 4-8 Use case Specification for Give Driving Clearance

5 Other Non-Functional Requirements

5.1 Performance Requirements

NFR001: The system shall give responses within 1 second after detecting any alcoholic substance in human body.

NFR002: The system shall support the capacity of having1 person being detected the alcohol content at a time.

NFR003: The system shall have its user interface screen respond after being switched within a time less than seconds.

NFR004: The system shall conform to the steering wheel it is deployed in a given vehicle.

NFR005: The system shall restart execution every after a period of 5 seconds so as to track drink driving.

NFR006: The system shall make use of very short and precise messages to present the results to the user.

NFR007: The system shall present the results of the alcohol content in the blood in percentage format.

NFR008: The system shall display a red light to show the detection of alcohol.

NFR009: The system shall display a green light to notify the user of the systems approval to drive.

5.2 Safety Requirements

NFRO10: The system shall have the infrared spectrometer used in the system not to have any adverse effects from the light rays emitted to the users of the system.

NFR011: The system's components shall also be well packaged to safe guard the users from any accidents that may be electrical or mechanical.

NFR012: The system shall not compromise the results to enable the user of the car to drive it by ensuring that tests are carried out every after 5 minutes.

5.3 Security Requirements

NFR013: The system shall only send the SMS message to only those contacts preregistered and available to the GSM module.

NFR014: The system is only restricted to owners of the car or any other motor vehicle that has such this particular system deployed in it

5.4 Software Quality Attributes

- AVAILABILITY: The system shall be available all the time.
- CORRECTNESS: A bug free software which fulfill the correct need/requirements of the client.
- MAINTAINABILITY: The ability to maintain, modify information and update fix problems of the system.
- USABILITY: software can be used again and again without distortion.
- ACCESSIBILITY: Administrator and many other users can access the system but the access level is controlled for each user according to their work scope.
- ACCURACY: The reliability on the information/output. Can depend/be sure of the outcome.
- STABILITY: The system outcome/output won't change time to time. Same output will be given always for a given input.

5.5 Business Rules

BR001: The stipulated percentage by the government of alcohol content that a driver of the car should have in order to drive a car will be put in consideration while developing the system.

BR002: The software team takes responsibility of failures due to hardware malfunctioning.

BR003: There is a warranty period of one year for maintaining the software system in case it does not perform to its specified functions.

BR004: Additional payments will be analyzed and charged for further maintenance.

BR005: If any error occurs due to a user's improper use. Warranty will not be allocated to it.

BR006: There will be no money back returns for the software.

BR007: Trust bond placement should be done before designing and coding. An advance or an Agreement.

6 Other Requirements

OR-1 Users of the system may request to have the GSM module of the system disabled in case don't want to receive SMS notifications to their contacts or phone numbers they registered.

OR-2 The system shall be upgraded where needed be by providing the necessary hardware and software that need to be enhanced to provide improved functionality.

OR-3 The system shall not retain or keep any records of the previous data that it collected from the users as a way of ensuring confidentiality.

OR-4 The system shall back up the user information such as the user's contact at least once a month to prevent any loss of data.

OR-5 The system shall roll back to restore the data to pre-session condition in case of an update failure when updates are being performed.

Appendix A: Glossary

Symbol	Definition
GMS	Global System for Mobile Communications.
SMS	Send Message.
IEEE	Institute of Electrical and Electronic Engineers.
RAM	Random Access Memory.
ROM	Read Only Memory.
NDIR	Non-Dispersive Infrared Spectroscopy.
FR	Functional Requirements.
BR	Business Rules.
NFR	Non-Functional Requirements.
OR	Other Requirements.
CPU	Central Processing Unit .
LCD	Liquid Crystal Display.

Appendix B: Analysis Models

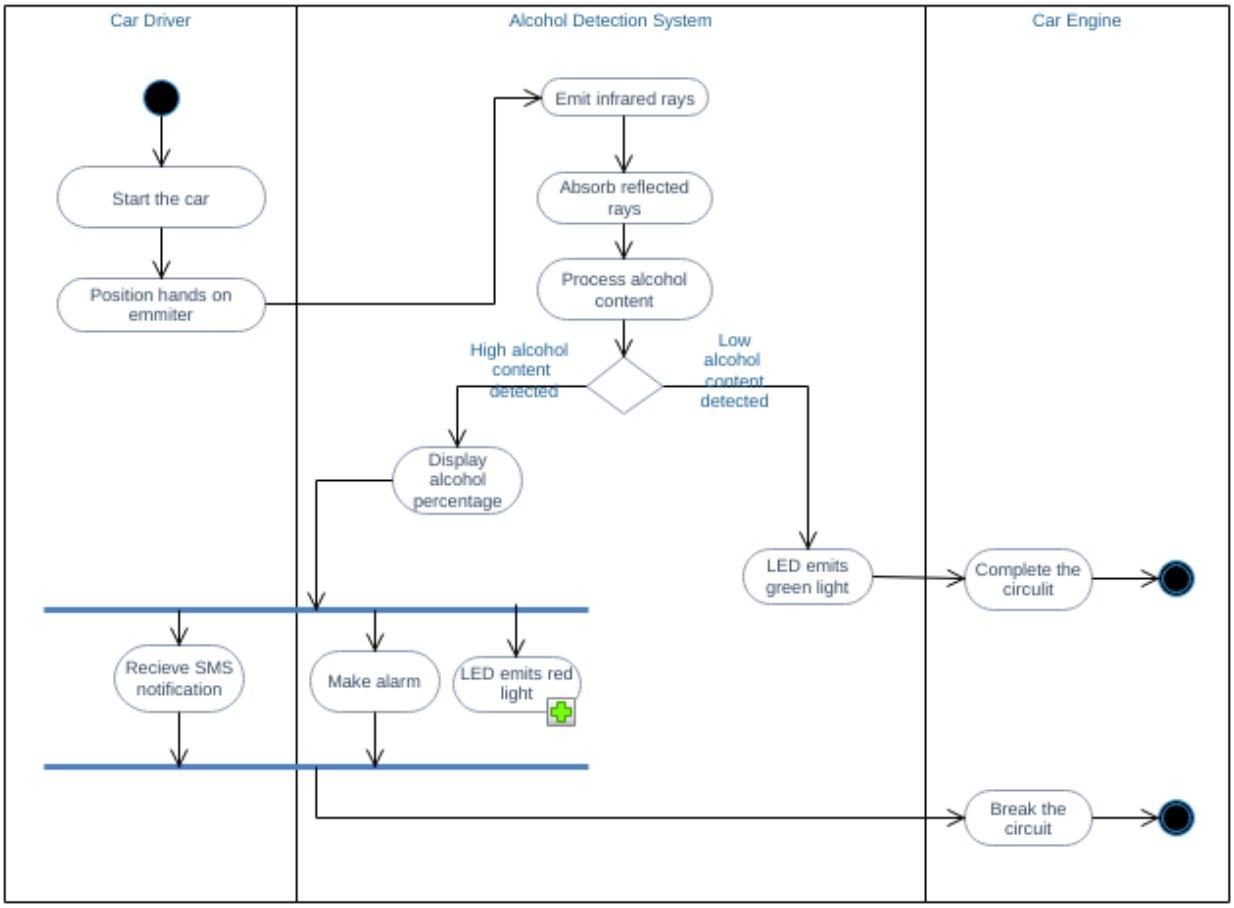

Figure 0-1 Activity Diagram

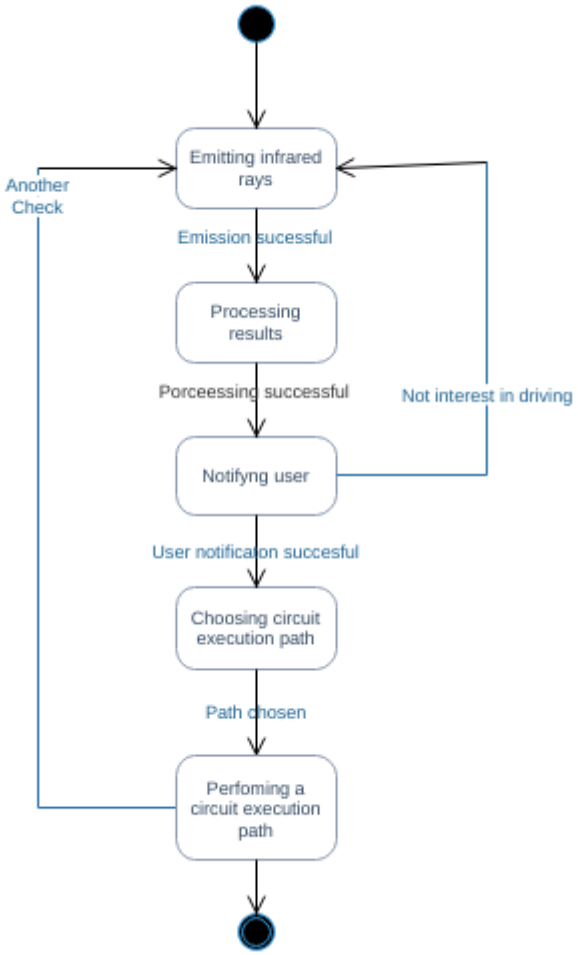

Figure 0-2 State Chart Diagram

Appendix C: To be Determined list

Bibliography

[1] Heyendaalseweg, "Optical Infrared Spectoscopy," 2019. [Online]. Available: https://www.ru.nl/systemschemistry/equipment/optical-spectroscopy/infrared/.

[2] S. Lauesen, "Task Descriptions as Functional Requirements, IEEE Computer Society,," 2003. [Online]. Available: http://www.itu.dk/~slauesen/Papers/IEEEtasks.pdf.

[3] N. Vision, "police start day time kawunyemu operations," 30 04 2015. [Online]. Available: https://www.newvision.co.ug/new_vision/news/1325054/police-start-daytime-kawunyemu-operations.

[4] 27222, "atmega16 pin diagram 3," 1 06 2017. [Online]. Available: https://electronicsforu.com/resources/learn-electronics/atmega16-pin-diagram-3.

[5] Headbomb, "System bus," 2005. [Online]. Available: https://en.m.wikipedia.org/wiki/System_bus.

[6] Jayant, "GSM module," 05 08 2015. [Online]. Available: https://circuitdigest.com/microcontroller-projects/gsm-module-interfacing-with-8051-at89s52.

[7] DIAGEO, "why drink driving is so dangerous," 2019. [Online]. Available: https://www.drinkiq.com/en-ke/how-alcohol-affects-us/when-alcohol-is-dangerous/why-drink-driving-is-so-dangerous/.

[8] UBL, "drink driving campaigns," 2019. [Online]. Available: https://www.ugandabreweries.com/sustainability/alcohol-society/drink-driving-campaigns.

[9] M. Joseph Kimuli, "Road traffic accidents in Uganda," 2019. [Online]. Available: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5279989/.

[10] A. Gitta, "kawunyemu app warns ugandas drink drivers of police checks," 2019. [Online]. Available: https://www.google.com/amp/s/amp.dw.com/en/kawunyemu-app-warns-ugandas-drink-drivers-of-police-checks/a-36401348.