Technical Manual
DRIVER DISTRACTION MANAGEMENT USING SENSOR DATA CLOUD

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1. Introduction

1.1. Document Identification

This document describes the design of the Driver Distraction Management Using Sensor Data Cloud. This document is prepared by Green Networking Research Group, Department of Computer Science and Engineering, University of Dhaka, Bangladesh

1.2. System Overview

Driver distraction can be defined as any type of event that takes away drivers visual, manual and cognitive attention from the driving task. To reduce the number of road accidents due to driver distraction, we design and implement a system for monitoring and controlling driver distraction in this project, which is cost-effective and highly accurate. This system is implemented using sensor based data collection and transmission scheme. To manage the collected data, a cloud data management infrastructure and a user-friendly interface is used. We analyse, design and implement innovative system services such as real-time information collection and reporting on driver's healthcare, providing alert messages in emergency cases, distraction levels determination, etc. At the end of the implementation period, purchase of all the sensors, data collection from the sensors, training on cloud infrastructure and services, writing research paper for dissemination of knowledge, creation of database, conduction of workshops and extensive verification procedures have been performed.

The Driver Distraction Management Using Sensor Data Cloud module has been assembled from the following subsystems, whose details are outlined in this report.

1.2.1. Subsystems used:

- Raspberry PI module
- Huawei E303 HSPA Modem Weigh/Count
- HD Webcam Factory User Options
- 3G SIM card
- GPS position and vehicular security condition identifier devices
- 2Amp 5V micro USB Power Supply
- Blip-Care Blood Pressure and Heart Rate measurement Device
- Alcohol vapour measurement sensors.
- Body temperature measurement sensors.
- ECG/EEG measurement sensors.
- Microcontroller circuitry for sensor management

1.2.2. Platforms and Utilities

- Java (Open JDK 7)
- Open CV
- Hostapd
- Sakis3G
- UMTS Keeper
- GNOME Scheduler
- MySQL JDBC Connector.

- Python
- Flow Code
- PHP
- MySQL
- PHPmyAdmin

1.2.3. Tools and Softwares:

- Win32 Disk Imager
- Putty
- WinSCP
- FileZilla
- Connectify

1.2.4. Web and Cloud services:

- Google Cloud Services.
- Dedicated VPS services.

1.3. Document Overview

This document details the design and implementation process of the Driver Distraction Management Using Sensor Data Cloud. It first describes the system as a whole before going into detail for each individual module. Interface designs as well as test carried out are also detailed.

1.4. Reference Documents

The present document is prepared on the basis of the following reference documents, and should be read in conjunction with them.

- "The role of driver distraction in traffic crashes." Prepared by Jane C. Stutts, Donald W. Reinfurt, and Loren Staplin, University of North Carolina, Highway Safety Research Center, Chapel Hill, NC, 2001.
- Study on Driver Distractions" by California Department of Motor. Vehicle,http://www.dmv.ca.gov/pubs/brochures/fast_facts/ffdl28.htm, Accessed on 21June, 2012.
- Government of People's Republic of Bangladesh, Ministry of Communication, Bangladesh Road Transport Authority, National Road Safety Strategic Action Plan 2011-2013.
- "Driver Distraction, Telematics Design, and Workload Managers: Safety Issues and Solutions", by Paul Green, SAE International 2004, paper number 2004-21-0022.

2. System Description

This section intends to give a general overview of the basis for the system design, of its division into hardware and software modules, and of its development and implementation.

2.1. Introduction

The Driver Distraction Management Using Sensor Data Cloud can generally be divided into two components, hardware and software.

Hardware components include:

- Raspberry PI module
- Huawei E303 HSPA Modem Weigh/Count
- HD Webcam Factory User Options
- 3G SIM card
- GPS position and vehicular security condition identifier devices
- 2Amp 5V micro USB Power Supply
- Blip-Care Blood Pressure and Heart Rate measurement Device
- Alcohol vapour measurement sensors.
- Body temperature measurement sensors.
- ECG/EEG measurement sensors.
- Microcontroller circuitry for sensor management

The software components:

- Win32 Disk Imager
- Putty
- WinSCP
- FileZilla
- Connectify
- Google Cloud Services.
- Dedicated VPS services.

Main controller and communication management unit: Raspberry PI

2.2. Operational Scenarios

The block diagram below is a representation of how each sub-module is linked to each other. The system can operate in one mode, user mode.

This system will contribute in managing the driver's physical and mental condition, and also the performance of the driver. Under the driver distraction monitoring and controlling system, whenever the physical or mental condition of the driver deteriorates beyond a threshold or the driver is somehow distracted, an alert message will be sent to the driver. This mechanism will decrease the probability of road accident due to driver distraction and thus it will be directly useful to **vehicle drivers** and **vehicle owners** and they will be the primary user of this driver distraction monitoring and controlling system.

2.3. System Requirements

The operational scenarios considered place certain requirements on the system, and on the modules that comprise it.

2.3.1. Power Requirements:

The Raspberry PI system is powered by a 2Amp 5V micro USB Power Supply when running. The alcohol and temperature circuitry is powered by 20V car battery.

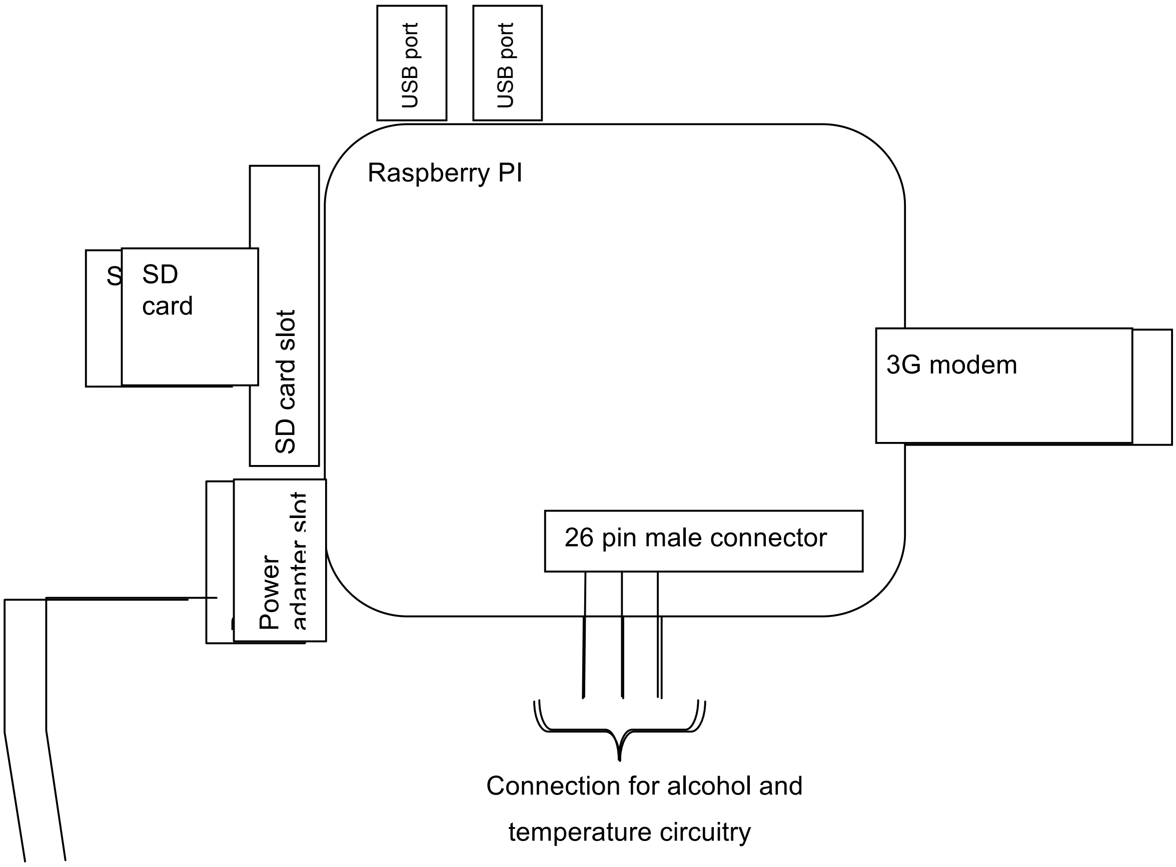


Figure 1: Block Diagram of the System

2.3.2. Operating System Requirements:

We need Windows XP or Linux or MAC OS to run our Raspberry PI

2.3.3. Application Software Requirements:

We some application software such as Virtual Router and putty.

2.3.4. Cloud Services Requirements:

We use Google Cloud services and dedicated VPS services.

3. Raspberry PI Initialization and Setup

Raspberry PI is the main system module that is housing the other sub-modules. Below we describe the initialization and setup procedure for Raspberry PI.

3.1. Raspberry PI as a microcontroller

We use Raspberry PI as our main communicating module. Raspberry PI is a mini Personal Computer (PC). We can have the full flexibility of coding, debugging, modelling, finalizing and most importantly maintaining the system. It is small and easily integratable with all the circuitry and devices.

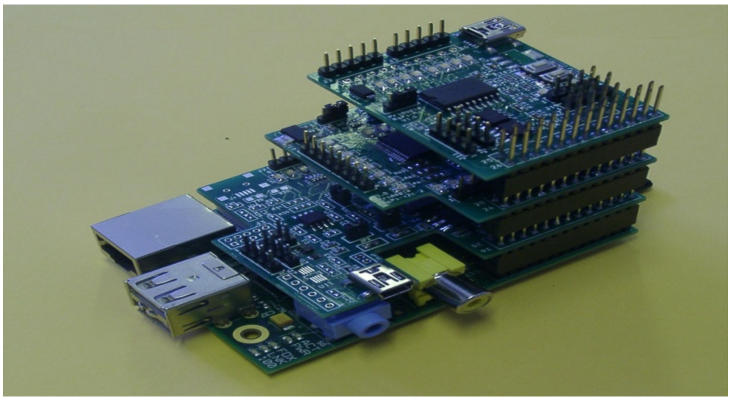


Figure 2: Raspberry PI

Moreover, we are using Debian version for ARM processors. Debian is famous to be the most stable linux distro. So, we have a PC with Debian, that supports almost every programming language and platforms. These are the prime reasons behind choosing Raspberry PI among all other options.

3.2. Unboxing RPI and preparing SD card for setup:

We need a SD card to run the Raspberry PI. It is the Hard Disk for this device. We recommend the capacity of the card to be at least 8GB. Then we need to download the .img file from raspberry images directory. We prefer the Debian platform. So, we need to download Raspbian image from the website http://www.raspberrypi.org .

3.3. Setting up the SD card:

Now, we have the SD card and the Raspbian image. We need to insert the SD card into the card reader. Download the application named Win32 Disk Imager from http://www.sourceforge.com and open it. Then, select the downloaded image to write on the SD card. Select the desired SD card to be written on. Then click the "Write" button. After finishing the operation eject the card.

3.4. Setting up Raspberry PI:

Now, SD card is ready for booting up. Connect the 2A 5V power supply to the R PI power slot. It will automatically finish setting itself up. Give it about 2minutes of time. Then you are ready to use Raspberry PI.

3.5. Getting into R PI from PC:

We want to control, use and program R PI from our PC. So, we need to create a home network to connect to the R PI. Now, we will download (http://www.connectify.me) and install Connectify software. We now share the working internet connection through an Ethernet interface (alternatively, we can use WiFi, but connecting using Ethernet makes it more consistent and easy). Now, from the shared Ethernet interface we will connect to the R PI's Ethernet interface using a CAT-5 wire with RJ45 connectors.

After connecting the Ethernet interfaces and starting Connectify, Power ON the R PI. After a while, in Connectify's connected devices list a device named "raspberrypi" will appear. Write down the IP address of the device.

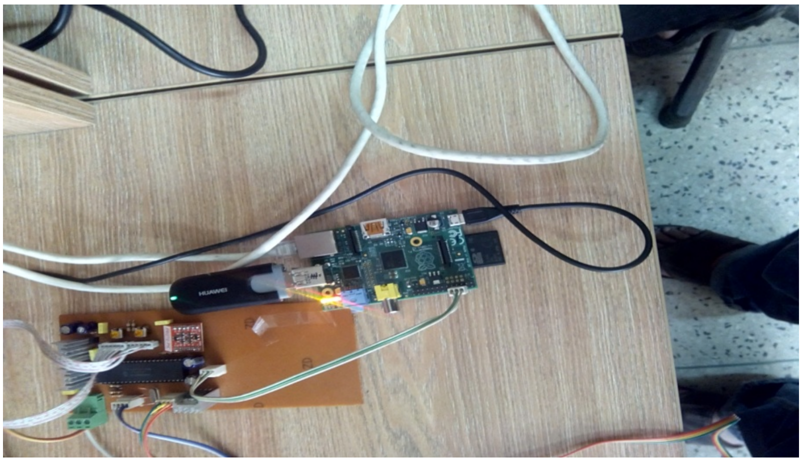
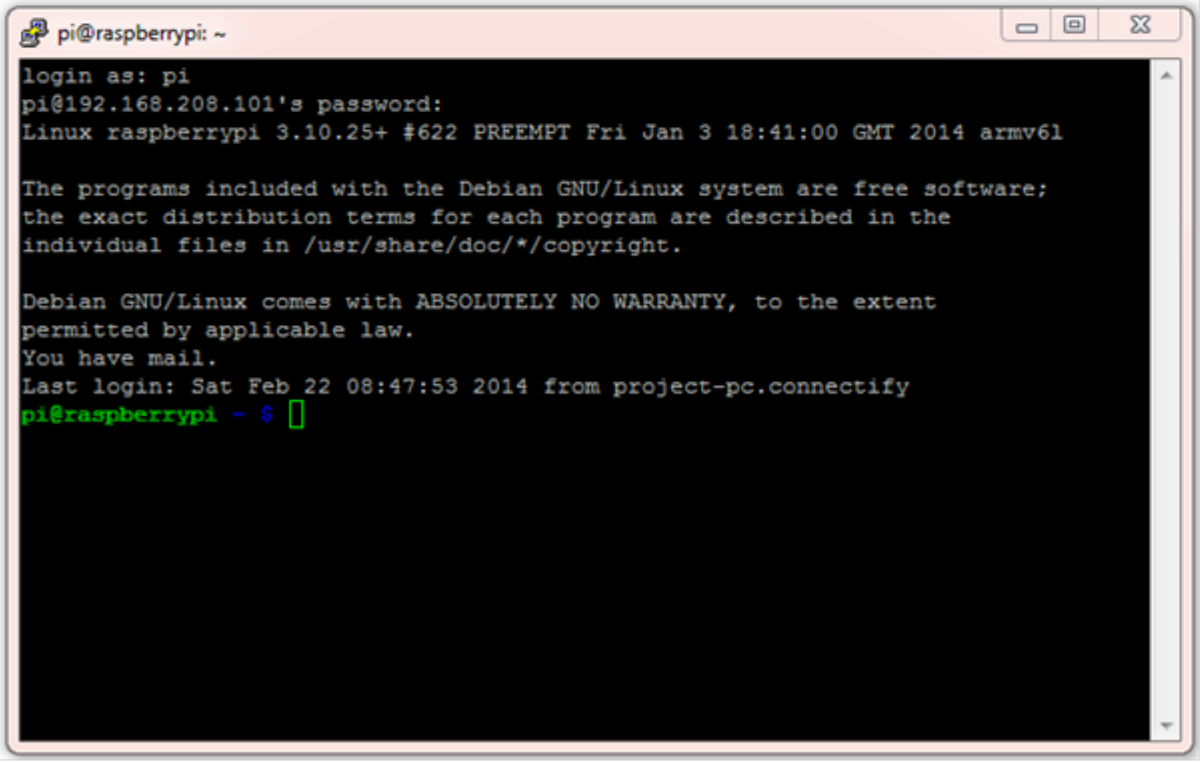


Figure 3: Setting up Raspberry PI

Now, download and install the software named "putty". Open it and in SSH tab, give the written ip there and click the open button. Now a terminal will appear. It is the bash terminal from the newly installed Raspberry PI.

We login to the R PI using username "pi" and password "raspberry". The first thing is to do with the terminal is extending the current root partition which can be done running the command "sudo raspi-config". An interactive shell will appear and it is easy to configure as needed.

We have used connectify to create virtual router. Anyone who has a physical router can easily connect the Raspberry PI with it via CAT5/6 Ethernet cable and configure it accordingly.



```
login as: pi
pi@192.168.208.101's password:
Linux raspberrypi 3.10.25+ #622 PREEMPT Fri Jan 3 18:41:00 GMT 2014 armv6l

The programs included with the Debian GNU/Linux system are free software;
the exact distribution terms for each program are described in the
individual files in /usr/share/doc/*/copyright.

Debian GNU/Linux comes with ABSOLUTELY NO WARRANTY, to the extent
permitted by applicable law.
You have mail.
Last login: Sat Feb 22 08:47:53 2014 from project-pc.connectify
pi@raspberrypi ~ $
```

Fig

3.6. Install tools and libraries:

3.6.1. Command Listing:

3.6.1.1. Commands to Upgrade:

Use these commands to update and upgrade the current installation in Raspberry PI.

i. sudo apt-get update

ii. sudo apt-get upgrade

3.6.1.2. Commands for Java Installation:

JDK + JRE (OpenJDK 7)

i. sudo apt-get install openjdk-7-jdk

ii. sudo apt-get install openjdk-7-jre

3.6.1.3. Python Serial Library Commands

i. sudo apt-get install python-serial

3.6.1.4. GNOME schedule Commands

i. sudo apt-get install gnome-schedule

3.6.1.5. MySQL support for JDBC:

Download MySQL JDBC connector JAR file from oracle website to the home directory /home/pi.

3.7. Install, configure and integrate 3G modem:

Here we used Huawei E303 HSPA modem. We are giving the tutorial for this model.

3.7.1. Make sure the Pi can see the 3g Dongle

To get more information about the USB devices connected to the Pi, we use the command 'lsusb'. Open a terminal window and type:

```
lsusb
```

Should give an output similar to this:

```
Bus 001 Device 002: ID 0424:9512 Standard Microsystems Corp.
Bus 001 Device 001: ID 1d6b:0002 Linux Foundation 2.0 root hub
Bus 001 Device 003: ID 0424:ec00 Standard Microsystems Corp.
Bus 001 Device 010: ID 12d1:1446 Huawei Technologies Co., Ltd.
E398 LTE/UMTS/GSM Modem/Networkcard
```

lsusb lists the usb devices connected to the Pi, either directly or through the hub. I've highlighted the parts of the output that indicates the 3g dongle can be seen by the Pi. Yours should look similar to this, although it will vary from model to model - most 3g dongles on the market seem to be a Huawei of one flavour of another at the moment. So long as there is a mention of 'modem' or 'UMTS', you should be laughing. What you don't want to see at this stage is this:

```
Bus 001 Device 010: ID 12d1:1436 Huawei Technologies Co., Ltd.
```

We will install usb_modeswitch. To install, in the terminal window type:

```
sudo apt-get install usb-modeswitch
```

Now in terminal type:

```
sudo reboot
```

and wait for getting rebooted and reconnect the Raspberry PI with putty again.
Now, type:

```
lsusb
```

And you should see,

```
Bus 001 Device 010: ID 12d1:1436 Huawei Technologies Co., Ltd.
```

tell the operating system the vendor ID and device ID. More information on USB identification can be found on the debian wiki. Notice that the first 4 characters of the device ID (vendor ID) are the same in both examples, but the last 4 (device ID) have changed. Usb-modeswitch forces the operating system to use the combination that corresponds to the 3g modem.

Now type,

```
sudo nano /etc/usb_modeswitch.conf
```

and append the lines to the file written below:

```
DefaultVendor = 0x12d1
DefaultProduct = 0x1506
MessageEndPoint = "0x01"
MessageContent =
"555342430000000000000000000000110600000000000000000 000000000000"
```

Hit Ctrl+O, Enter, Ctrl+X to save changes and exit.

3.7.2. Download and setup ppp, UMTSKeeper and Sakis3g

3.7.2.1. pppd

The ppp package will install the point to point protocol daemon, which will manage the connection between you and your 3g provider. The package can be installed via the terminal with the command:

```
sudo apt-get install ppp
```

Nothing further needs to happen with pppd, it should just sit there in the background, as a daemon are supposed to, waiting for Sakis3g to control it.

3.7.2.2. UMTSKeeper

UMTSkeeper is used to automatically reconnect the 3g dongle using the Sakis3g script should the connection drop, which actually happens with monotonous regularity in Kenya.

Download and unpack UMTSkeeper by issuing the following commands from the terminal window:

```
sudo mkdir umtskeeper
cd umtskeeper
sudo wget "http://zool33.uni-graz.at/petz/umtskeeper/src/umtskeeper.tar.gz"
sudo tar -xzvf umtskeeper.tar.gz
sudo chmod +x umtskeeper
```

The first command created a folder called 'umtskeeper' in the current directory you are in. To confirm what this directory is, type 'pwd'. Make note of the output, as we will need the full path to automate UMTS keeper later. Now we will download Sakis3g into the same directory to keep things simple.

3.7.2.3. Sakis3g

Sakis3g is a script used to make a 3g connection. You need to be able to provide a few details: your APN, the PIN for your SIM card and your username and password if your provider requires them. This information can (hopefully) be found on your providers website or in the documentation that came with your simcard/dongle. If not, a search on google for '*your provider* APN settings' should unearth them.

The sakis-3g.org website has been down for some time. Fortunately somebody has uploaded a copy of the script to SourceForge. To download and unpack it, issue the following commands from the terminal window:

```
sudo wget "http://downloads.sourceforge.net/project/vim-
n4n0/sakis3g.tar.gz?r=http%3A%2F%2Fsourceforge.net%2Fpro
jects%2Fvim-
n4n0%2Ffiles%2F&ts=1363537696&use_mirror=tene~t" -O
sakis3g.tar.gz
sudo tar -xzvf sakis3g.tar.gz
sudo chmod +x sakis3g
```

Now test UMTSkeeper. The command at first may look a bit confusing (the details are for our connection):

```
./umtskeeper --sakisoperators "USBINTERFACE='0'
OTHER='USBMODEM' USBMODEM='12d1:1436'
APN='CUSTOM_APN' CUSTOM_APN='wap' SIM_PIN='1234'
APN_USER=' ' APN_PASS=' '" --sakisswitches "--sudo --
console" --devicename 'Huawei' --log --silent --monthstart 8 --nat
'no'
```

Breaking it down a little, these are the areas that you will need to change:

USBMODEM: The Device ID we found using the lsusb command earlier

CUSTOM_APN, APN_USER, APN_PASS, SIM_PIN: Information about your sim card and your providers data network.

A full breakdown of the parameters can be found on the UMTSKeeper site.

Now put a command on the terminal:

```
crontab –e
```

After the last line of the file add the following single line, edited to show your path to the umtsfolder you found with the 'pwd' command earlier:

@reboot **PATH GOES HERE**/umtskeeper --sakisoperators "USBINTERFACE='0' OTHER='USBMODEM' USBMODEM='12d1:1436' APN='CUSTOM_APN' CUSTOM_APN='wap' SIM_PIN='1234' APN_USER=' ' APN_PASS=' '" --sakisswitches "--sudo --console" --devicename 'Huawei' --log --silent --monthstart 8 --nat 'no'

Hit Ctrl+O, Enter, Ctrl+X to save changes and exit.
Now reboot using: sudo reboot

We are done with 3G modem now.

3.8. Install OpenCV:

Install OpenCV on Ubuntu Linux is a bit long but very easy. Simply, follow these steps:

3.8.1. Update and Upgrade Ubuntu

Open your terminal and execute:

```
sudo apt-get update
sudo apt-get upgrade
```

3.8.2. Install the Dependencies

Now execute:

```
sudo apt-get install build-essential libgtk2.0-dev libjpeg-dev libtiff4-dev libjasper-dev libopenexr-dev cmake python-dev python-numpy python-tk libtbb-dev libeigen2-dev yasm libfaac-dev libopencore-amrnb-dev libopencore-amrwb-dev libtheora-dev libvorbis-dev libxvidcore-dev libx264-dev libqt4-dev libqt4-opengl-dev sphinx-common texlive-latex-extra libv4l-dev libdc1394-22-dev libavcodec-dev libavformat-dev libswscale-dev
```

3.8.3. Download and Decompress Opencv

Execute:

```
wget “http://downloads.sourceforge.net/project/opencvlibrary/opencv-unix/2.4.8/opencv-2.4.8.zip?r=&ts=1392703029&use_mirror=skylink”
```

```
unzip opencv-2.4.8.zip
```

3.8.4. Compile Opencv

Now, in your terminal, **make sure you are within the OpenCV directory** and run the following commands:

```
mkdir build
cd build
cmake -D WITH_TBB=ON -D BUILD_NEW_PYTHON_SUPPORT=ON -D
WITH_V4L=ON -D INSTALL_C_EXAMPLES=ON -D
```

```
INSTALL_PYTHON_EXAMPLES=ON -D BUILD_EXAMPLES=ON -D
WITH_QT=ON -D WITH_OPENGL=ON ..
make
sudo make install
```

3.8.5. 5. Configure Opencv

In your terminal, execute:

```
sudo nano /etc/ld.so.conf.d/opencv.conf
```

Add the following line and save it:

```
/usr/local/lib
```

Now, in your terminal, execute:

```
sudo ldconfig
```

Again, execute:

```
sudo gedit /etc/bash.bashrc
```

Add the following two lines at the end of the file and save it:

```
PKG_CONFIG_PATH=$PKG_CONFIG_PATH:/usr/local/lib/pkgconfig
export PKG_CONFIG_PATH
```

Finally, reboot your computer.

3.9. Finalize:

Execute,

```
sudo pico /etc/inittab
```

The last line should be changed to,

```
#T0:23:respawn:/sbin/getty -L ttyAMA0 115200
```

Execute,

```
sudo nano /boot/cmdline.txt
```

delete the whole line and paste this

```
dwc_otg.lpm_enable=0 console=tty1 root=/dev/mmcblk0p2 rootfstype=ext4
elevator=deadline rootwait
```

Hit Ctrl+O, Enter, Ctrl+X

Now the total system is ready for the operation. Please, compile and run source codes or patch the given firmware accordingly.

4. Camera installation and setup

For monitoring drowsiness, eye movement, speaking behaviour, texting and phone calling we use a HD camera the setup procedure is given below:

4.1. Create test directory:

In the Desktop of Raspberry module, create a directory named test using the following command in your terminal:

```
cd /home/pi/Desktop

mkdir test
```

4.2. Copy the executable and the xml files in test:

Copy all the xml files created after compiling the camera operation module to the *test* directory. Also copy the executable contest file to *test* directory.

4.3. Create Shell File:

Open your terminal and execute the following commands:

```
cd /home/pi/Desktop

touch camera_schedule.sh
```

Open camera_schedule.sh using any file editor and write following lines in the file:

```
Cd /home/pi/Desktop/test

./contest
```

Save and close the file.

4.4. Run the camera module:

The camera module will execute for 30 seconds and terminate. To run the camera module repeatedly after 2 minutes, open your terminal and execute

```
crontab –e
```

Go to the end of the file and write:

```
*/2 * * * * sudo /home/pi/Desktop/camera_schedule.sh
```

Press Ctrl+O to write and press Enter to confirm the writing. Now, press Ctrl+X.

5. Camera Sensing Methodology

Drowsiness and speaking detection system have been implemented over C/C++ and OpenCV platform. A freeware library flandmark has been used for eye corner and mouth corner recognition purpose. Image size has been restricted to 320X240 as the computing system raspberry PI gets poor responses with images of bigger sizes. In order to detect drowsy eyes a combined approach of OpenCV realtime object recognition function and adaptive threshold along with vertical scanning has been used here. Both OpenCV and flandmark library help to point out appropriate face features in image. Later, adaptive threshold helps to reduce the illumination problem from the captured noisy images and to figure out the remedy of driver's drowsiness detection. For speaking detection, we use OpenCV haar object detection function along with adaptive threshold for binaraization. The binarized image is later used to approximate the mouth height and from the outcome of current mouth height to width ratio, we guess the driver's speaking state. Speaking and drowsiness warning along with device ID number is written to activityLog.txt after a minute interval. If driver is not in the seat or face can not be recognized due to distraction, an alarming message is also written to the activityLog.txt. Shortcomings regarding to this system is that driver must not use spectacles through driving as reflection might give erroneous indication about the state. Though Haar object detection for spectacles has been used for optimized eye detection, illumination and reflection often could not give reliable information with spectacles. It gives best results when driver's face aligned straight to the camera.

6. Blood Pressure and Heart Rate Monitoring Methodology:

We have used Blipcare blood pressure and heart rate monitoring device. Blipcare is Wi-Fi enabled so we setup our device by accessing its ip address.

6.1. Creating a Mobile Hotspot

We can create a mobile Hotspot on the driver's smartphone. Using wireless tethering service provided by the smartphone we create a mobile hotspot. Of course, this will need the mobile data functionality to be active.

6.2. Accessing Blipcare

On power up blipcare shows an AP sign. This is transmitting connection beacon. Scanning the vicinity will show the device on the wireless connection list. Connecting to the device and accessing it via the private IP 192.168.101.1 will give the user access to hook the device to an internet connection. By providing credentials, one must give the mobile hotspots credentials.

6.3. Accessing the Web Portal of Blipcare

Programmers have written a java code to automatically login to users account, fetch the latest data, and store it in the database. This program is running constantly and whenever there is a new data available it updates the database.

7. Data Transmission Methodology

Camera Data is written in a file in Desktop named *'ActivityLog.txt'*. Alcohol and Temperature data is collected in a file at /home/pi named 'templog.txt'. Data form theses files is read, transmitted, stored in a mirror file and erased from these files using a java program. That java program is also used to connect to a remote database and data is sent continuously to that remote database. Process of connecting to the remote server and transmitting data is described below:

7.1. Connecting to the Database

MySQL JDBC driver is used to connect to the remote server. Connection at port 3306 (MySQL port) to the remote server is established. To send data to a specific table in the database server, standard MySQL query is made and executed.

7.2. Alcohol Data Transmission

Alcohol data is sensed for a minute form the file. Data from the file is parsed using the java **split()** method. If the data is above a threshold level, data is accumulated. When the time stamp of one minute is over, all the accumulated data is averaged and sent to the database. Threshold level is set judiciously after going through a number of trial and error steps. At the time of transmission, a mirror file named *'tampMirror.txt'* is created where a copy of the sensed data is kept.

7.3. Temperature Data Transmission

00Temperature data is kept in the same file ‘templog.txt’ along with the alcohol data. Temperature is processed in the same way as alcohol data. Temperature data is originally measured in *‘Celsius’* scale and then converted to *‘Fahrenheit’* scale. The temperature values are also observed for a minute, averaged, mirrored and finally transmitted. The mirroring file is also the *‘tempMirror.txt’*.

7.4. Eye Movement Data Transmission

Data from camera is kept in the Desktop in a file named ‘Activitylog.txt’. If the eyes of the user are open the data is ‘0’ and if eyes are closed, data is ‘1’. If the eyes are not detected, data is ‘-1’. Data value containing ‘-1’ is ignored. All other values are summed and averaged and then sent to the database. In this case, the mirror of the sensed data is kept in a file named ‘activMirror.txt’ in Desktop.

7.5. Speak Detection Data Transmission

Speak detection is performed by the camera. In this case also, data value is ‘0’ for not speaking, ‘1’ for speaking and ‘-1’ if the face of the user is not detected. Data for speaking is also summed and averaged for a minute and sent to the server.

7.6. Blood Pressure and Heart Rate Data Transmission

Blood pressure and heart rate monitoring has been done by Blipcare blood pressure monitoring device. It is a Wi-Fi enabled device the blood pressure and heart rate monitored through this device will be sent to Blipcares server, which could be accessed through their web portal. A Java program has been developed to fetch those data to our own server. We need a mobile hotspot paired with Blipcare to access the internet.

7.7. Compiling and Running Data Transmission Method:

In your Desktop, create a directory named DBConnect. Go to your terminal and type:

```
cd /home/pi/Desktop

mkdir DBConnect
```

Copy the file DataSend.java file and the MySQL connector package in the DBConnect directory. Use the

```
cp ‘filename’ ‘destination-address’
```

command to copy files.

Compile the DataSend.java file. Open your terminal and write:

```
cd /home/pi/Desktop/DBConnect
javac DataSend.java
```

In your Desktop create a shell file to run the data transmission file. Open your terminal and wirte:

```
cd /home/pi/Desktop
touch DataSend.sh
nano DataSend.sh
```

A file named DataSend.sh will open. Write the following lines in the file:

```
cd /home/pi/Desktop/DBConnect
java DataSend
```

Now, open crontab.

```
crontab –e
```

Write the following line at the end of crontab to run the data sending file repeatedly after one minute.

```
*/1 * * * * sudo /home/pi/Desktop/DataSend.sh
```

Press Ctrl+O to write and press Enter to confirm writing. Finally, press Ctrl+X to exit crontab.

The following code fragment is used for accessing the database from a java program:

```
//database.....
      Connection conn = null;
      Statement stmt = null;
      ResultSet rs = null;
      try {
          // Loading Driver
          Class.forName(driverName);
          // Creating Connection
          System.out.println("it works...");
          conn = DriverManager.getConnection(connectionUrl, userName,
password);
          // Setting auto commit false
          conn.setAutoCommit(false);
          System.out.println("Databese Connection Done........");
          } catch (ClassNotFoundException e) {
          System.out.println(e.toString());
          System.out.println("Error In Connection");
          System.exit(0);
          } catch (SQLException e) {
          e.printStackTrace();
          }
          try {
          //date and time
             SimpleDateFormat sdfDate = new SimpleDateFormat("yyyy-MM-dd
HH:mm:ss");                Date now = new Date();
             String strDate = sdfDate.format(now);
             System.out.println(strDate);
             // Creating Statement
             stmt = conn.createStatement();
             // Creating Query String
             String updateQuery1 = "INSERT INTO "+"snsr_bph "+"VALUES "+"(
'"+strDate+"' , "+systi+", "+diai+", "+ hri+", '"+regno +"')";
                        stmt.executeUpdate(updateQuery1);

              // Calling commit() method
              conn.commit();
                   } catch (Exception e) {
                        e.printStackTrace();
                    } finally {
                        // Closing Connection
                        if (conn != null) {
                            try {
                                conn.close();
                            } catch (SQLException e) {

                            }
                        }
                        if (stmt != null) {
                            try {
                                stmt.close();
                            } catch (SQLException e) {

                            }
                        }
```

```
        if (rs != null) {
            try {
                rs.close();
            } catch (SQLException e) {

            }
        }
        System.out.println("Connection Closed.........");
    }

}
```

8. Cloud Computing

8.1. Cloud Computing Environment

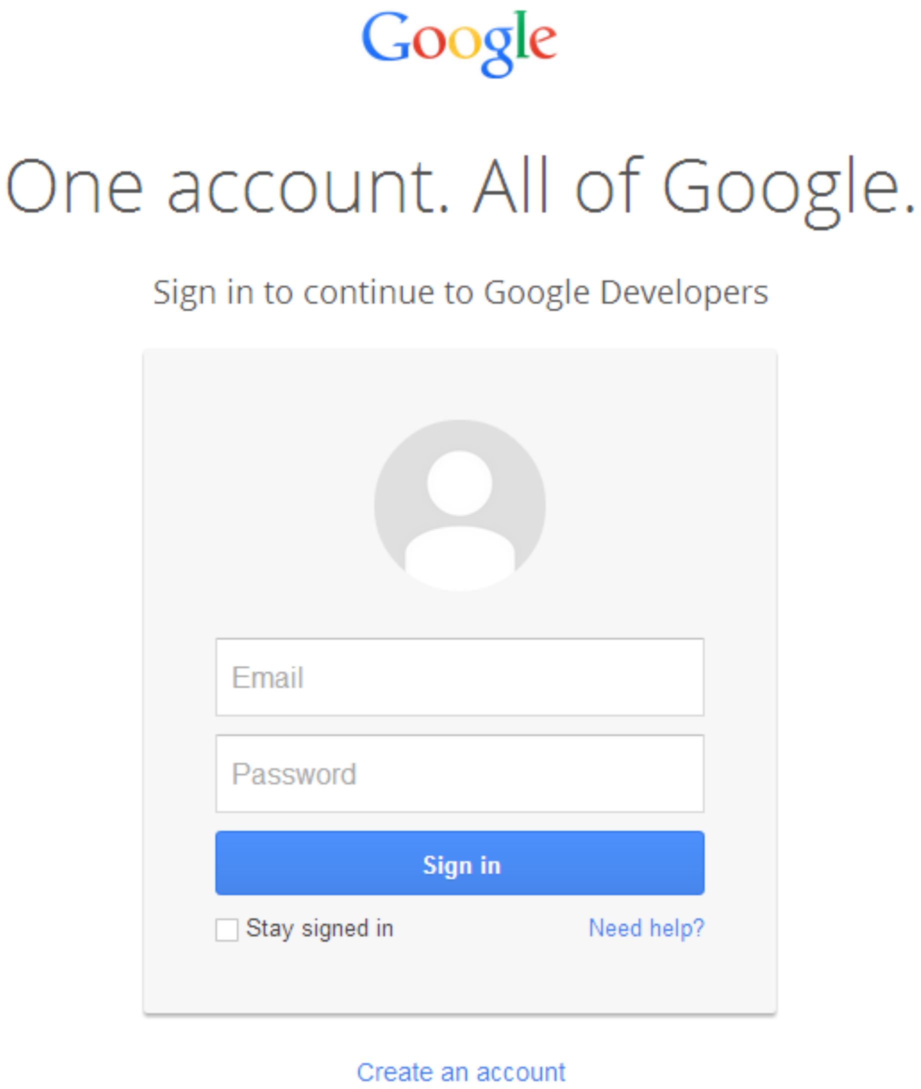
In cloud computing, resources (compute, Disk space, Request per minute etc.) can be scaled dynamically according to user requirement. To providing greater user access to the stored data, improve quality of the services provided to the users and dynamically scale database size, we have used Google Cloud Computing Environment. We have used Google ‘Compute Engine’ for hiring an instance where our database and web-server has been installed.

8.2. Importance of Cloud Computing

Cloud computing environment for web-server is necessary. This is because, as the time goes, the size of the database will increase exponentially. So, a highly scalable and robust server is a must. Cloud providers supply VM instances which assures these qualities with a relatively low price. We don’t need big capital to buy servers; rather we hire them from cloud. In cloud computing, we can also dynamically set the rate of user access per minute which will help to improve quality of services provided to user when the number of user increases.

8.3. Setup of the Cloud Server

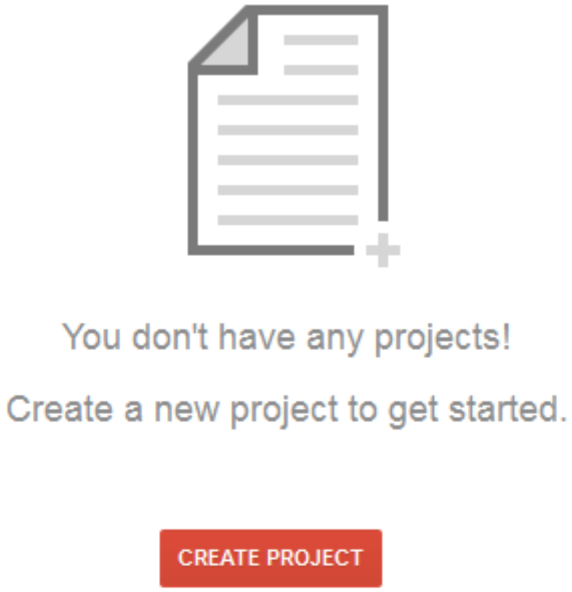
First, create an account in Google Cloud.



One account. All of Google.

Sign in to continue to Google Developers

Press the Go to my console link. Then create a new project.

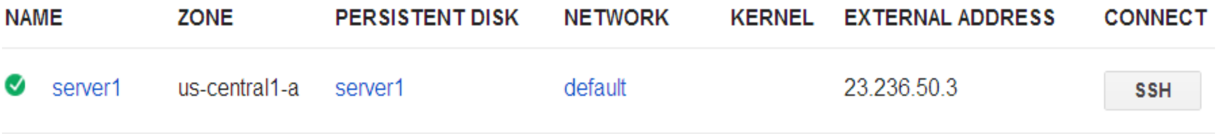


You don't have any projects!

Create a new project to get started.

After creating the project, press the compute engine link. Then enable billing for the compute engine by giving the necessary information and bill pay card information. Then create a new instance by pressing the button ‘new instance’.

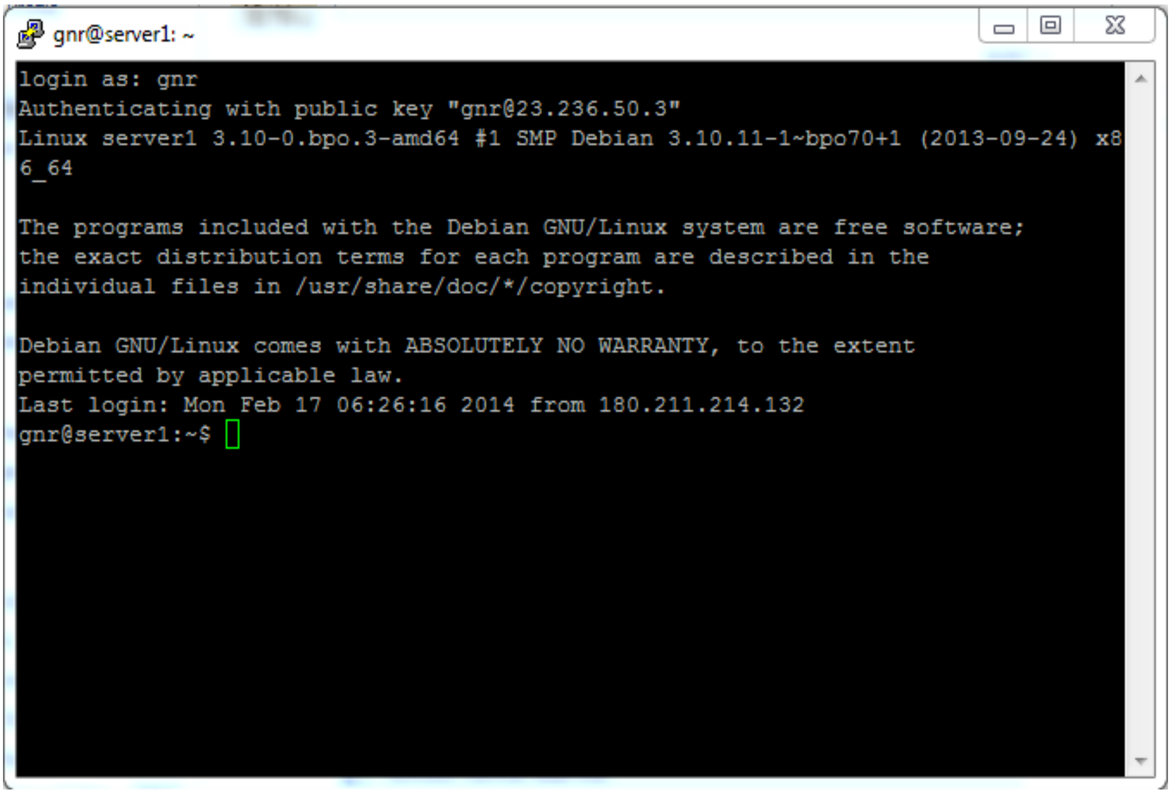
Give the information regarding the instance like name, description, instance type, zone, additional disk and image if required. Select a static IP address and finish the task by providing the access information. After creation of the instance, information about that instance will be shown.



NAME	ZONE	PERSISTENT DISK	NETWORK	KERNEL	EXTERNAL ADDRESS	CONNECT
✓ server1	us-central1-a	server1	default		23.236.50.3	SSH

8.4. Configuration

By default in the cloud instance, Google gives you latest Debian distro installed. You need to create a SSH private key according to the User Manual of Google Cloud services. Using the private key, login to the cloud server using putty.



```
login as: gnr
Authenticating with public key "gnr@23.236.50.3"
Linux server1 3.10-0.bpo.3-amd64 #1 SMP Debian 3.10.11-1~bpo70+1 (2013-09-24) x8
6_64

The programs included with the Debian GNU/Linux system are free software;
the exact distribution terms for each program are described in the
individual files in /usr/share/doc/*/copyright.

Debian GNU/Linux comes with ABSOLUTELY NO WARRANTY, to the extent
permitted by applicable law.
Last login: Mon Feb 17 06:26:16 2014 from 180.211.214.132
gnr@server1:~$
```

Figure 5 Logging into Google Cloud

The next step is to install Apache server, MySQL database server and PHP libraries for getting started with Web services. The easiest way is to create a LAMPP stack (details can be found in https://www.digitalocean.com/community/articles/how-to-install-linux-apache-mysql-php-lamp-stack-on-debian).

After installing LAMPP stack we are ready to roll. Now, we need to configure apache server to host the websites. Apache has its own documentations on detailed server configuration. To control and maintain MySQL server easily, we use PHPMyAdmin.

8.5. Management

We back up our running services and their data and synchronize accordingly the main server with the back-up server. So, we create the exact copy of the database and website files in another VPS (Virtual Private Server) and this needs to be done periodically. We create dynamic websites to provide services for the product users. We ensure data integrity and user affability. All the data are automatically backed up by our maintenance system and the cloud itself. Debian is vastly used in servers of corporate use. So, reliability is guaranteed.

9. User Interface Design

9.1. Wordpress-a website management system

We have developed our website in wordpress CMS platform. The Wordpress CMS allows the user to easily update the text, images and other content on the website without the need for technical staff or prior knowledge of website maintenance. Wordpress CMS is a web-based system, so it can be used to amend our site where ever we are in the world as long as we have access to the internet. This ensures our website is always up-to-date and allows us to react quickly and make changes instantly. Wordpress CMS is extremely powerful but it has been designed specifically to allow inexperienced users to take control of their site with ease and confidence.

9.2. Usable websites

We design all our websites with usability in mind, which means the sites are easy to use and the users can easily find the information they need. We ensure the following things in our website.

- The navigation is clear and easy to use
- The user find what they want in the minimum amount of clicks
- The pages are quick to download.

9.3. Search engine friendly sites

We ensure that all aspects of our website are search engine ready, using site optimization techniques, so that search engines can easily access our entire website effectively. For this reason our website ensures that:

- URLs of the site include keywords relating to the content of the page
- Every page has a title describing what the page is about this will be displayed by Google and at the top of the browser
- Every page has a meta-description which is used by Google as the description of the site
- Every page has a heading displayed at the start of the page content
- There is no content which the search engines cannot read due to flash or frames

9.4. Accessible Websites

An accessible website is one which all people can access on any browser, operating system, screen size or device. With the increasing use of SmartPhone, (especially iPhones and Androids) and the use of games consoles and large format televisions to view the internet; it is essential that any website works across all devices and many different types of browsers. By using CSS and template technology our websites are highly accessible. We also ensure that our website is able to be printed out in a clear format.

9.5. The Disability Discrimination Act (DDA)

The Disability Discrimination Act (DDA) stipulates that websites must meet a minimum standard of accessibility. Our accessible websites help people with limited dexterity, low vision, or have to view the website with the help of a screen reader.

9.6. Functionality of our Website

Just as any popular website, our website and user support has all the essential features and some more. Functionalities are described below:

9.6.1. General Features

- Simple and easy to use - if anyone can use Microsoft WORD he/she can use Wordpress.
- Secure on-line administration area – we can update our website anywhere in the world
- Instantly change website content by us - no technical staff required!
- Complete separation of design and content
- Compatibility with all major platforms - desktop, laptop, netbooks, games consoles or mobile phones (iPhone, Smart Phones, iPad)
- Import and export to other systems – e.g. you can export your customer database details into our (or your own) email broadcasting system

9.6.2. Website management

- Easy management of the navigation and site menus on the website
- XSL Template Architecture
- Check status of our site and if pages have any validation errors
- Intelligent content caching
- Site statistics and integration with Google Analytics

9.6.3. File and image management

- Document Vault - Upload all types of files to the site
- Scale and crop images to reduce or increase the size
- Upload and storage of multi-media files, including videos and sound files

9.6.4. User management

9.6.4.1. Front-end

This is how the data is displayed to the user**.** This consists of forms, search results and data extracted from the data-tables e.g. details of a specific product**.**

9.6.4.2. Admin area

This is the control panel that we access (with a password) to manage our website. The database elements of our website are managed through the “Form/database manager” and the “Data manager”.

9.6.4.3. Back-end

This is the area where the data is stored in a series of linked tables and is only accessed by our programmers

9.6.4.4. User-areas

This is a secure area that can be accessed by a customer or member. They can either be a read-only area where they can access secure content or an interactive area where they can amend their profile and see specific data relating only to them.

9.7. Adding ecommerce functionality to a database-driven website

If required, we can add a shopping cart and ecommerce options to our website, to allow us to take online payments.

9.8. Testing that our website works in different browsers

The website is constructed to be viewable in a number of browsers and across multiple platforms. Certain browsers can display pages in different ways, which can cause problems with some designs. As a minimum the site should work in line with the signed off design for the latest and previous version of the following browsers

- Internet Explorer (v8 and v7)
- Mozilla Firefox (v3.6 and v3)
- Google Chrome
- Safari (v5, 4 and 3)

The site will also be tested to ensure that it works in older browsers such as Internet Explorer 6 but there will be no guarantee that it will look exactly the same as in the signed off design.

9.9. Coding validation

Once the site is completed certain parts of it can be validated to check that it is correct. The following will be tested.

9.9.1.1. HTML Validation

Using the following link the primary parts of the site will be checked to ensure they have zero errors in them. This includes the home page and any other pages which use a different template. http://validator.w3.org/

9.9.1.2. CSS Validation

Using the link below all the style sheets for the site has checked to be error free. There are usually at least 3 style sheets for the site, one for layout (layout.css) one for the style of the text and links (style.css) and one for displaying the site when it is printed (printer.css). http://jigsaw.w3.org/css-validator/

9.10. Security

Security is provided at two levels:

- The website administration area (CMS) will have operating system security applied to it using apache and htaccess.
- Usernames and passwords will be created by GNR group. There will be no facility for the client to amend these themselves.

9.11. Security testing

The website has tested to ensure that certain areas of the site can only be accessed by the correct people.

The following security checks have performed:

- The admin area can only be accessed using a username and password
- The log files area can only be accessed using a username and password
- The websites forms are not open to SQL injection attack

10. Software Design

10.1. Software Design Process

10.1.1. Software Development Environment

The programmers used Java as the default programming language. JDK version 7 was used. For database JDBC platform was used. MySQL connectors were used to support queries in the database from programs. Cron tab was used for scheduling purposes of the sub-modules.

10.1.2. Software Implementation Stages and Test Plans

The software is divided into different module first, some are written to support corresponding hardware, others are for the driver distraction management module to perform certain function. Global variables are set to be the same in all individual modules to make integration in later stage easier to perform.

The integration will take place, first all the software for assisting the performance of hardware are assembled. Once all these hardware are reacting in the fashion desired, coding for different functionalities are implemented, and then tests are conducted for the entire system under different conditions to test the overall accuracy of it.

Each sub-module such as the alcohol detection, temperature measurement, blood pressure and heart rate monitoring goes through individual unit of testing, where a selection of inputs and outputs are recorded and the outputs compared with precise values. Next a selection of modules are integrated and tests are carried out once again. When the results are satisfactory, the whole system is compiled with all the software and hardware modules and final tests are carried out.

10.2. Software Quality Assurance

The coding from everyone is required to be understandable; this ensures that all group members can understand each other’s code. Everyone should try keeping to one style of coding. Extensive documentation were written during the coding phrase so that the code is easier to debug later on. For technical documentations, each group member uses a different colour font to prevent confusion in later days.

11. System Performance

11.1.1. Performance Testing

The system was able to iterate through the respective features.

- Easy installation
- Real time data collection and transmission
- Accurate threat detection
- Precise distraction level detection
- Alert and alarm generation
- Periodic report
- Website updates
- Query processing in the website
- System reset in case of failure

11.1.2. State of the System as Delivered

The final state of the system as delivered on January 2014 was essentially the working prototype for the entire module. A fully functional prototype along with the website makes the system a robust one.

11.1.3. Future Improvements

The following could improve:

- Added efficiency in data processing and transmission
- Quality of service improvement in Cloud Computing Environment
- Designing of a low power consuming MAC protocol
- Interaction with users and Improvement of the system according to their remarks
- Make the website more user friendly
- Generation of report of different types using various parameters

12. Safety Implications

While handling the module to avoid any hazardous situation one should keep in mind the following safety measures:

- Make sure all the wires are properly connected to prevent an electrical short – this could start a fire
- Wear Insulated footwear when operating on the inside of the unit
- Any modification without training in the discipline is advised against

13. Conclusions

The fundamental aspect of this process is not the task itself but the way in which engineers communicate and cooperate as a team and contribute with dedication as an individual to get a job done. Without this, not only will the final product suffer, but friendships and impressions of people can change forever.