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CONTEMPORARY SCIENCES AND TECHNOLOGIES

POST GRADUATE STUDIES-SECOND CYCLE

THESIS:

USING WEARABLE DEVICES FOR HABIT IMPROVEMENT

HIP (HABIT IMPROVE POLICE)

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To whom it may concern

This is to certify that the paper with the title "Using wearable device for habit improvement hip" (Habit improve police) written by Granit Ahmeti was edited for proper English language, grammar, punctuation, spelling and overall style. Neither the research content nor the author's intentions were altered in any way during editing process. If you have any questions or concerns about this edited document, please contact me at mirije_mm@hotmail.com.

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15.06.2017

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Declaration

I hereby declare on my honor that this Master's thesis submitted in South East European University is my own academic work and it does not contain other people's work without this being stated; and all the literature that I have used in writing the thesis are part of the bibliography and that this bibliography contains all referred references.

Granit Ahmeti

_____

2017

Acknowledgment

I would like to express my gratitude to all persons who have contributed for my studies. First of all I would like to thank my mentor Prof. Dr. Azir Aliu that he supported me during my thesis; also I would like to give a special thanks to my family and my friends. Thanks to all for being so good to me who motivated, advised and encouraged me.

Granit Ahmeti

Dedication

This work I would love to dedicate to my two brothers my sister and parents That they have supported me and ecouraged me to achieve success in my academical achievements.

Content

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Abstract

Caring is a good habit for our health, something we create in years, without thinking instinctively we udertake some actions and protect our organism from different threats, we feed ourselves, we avoid different dangerous situation, also always we try to pleasure our self with required needs, habits are so close related to people that can affect their life in many areas depend on what we use for. Generally we know that overeating is a bad habit, not exercising is also a bad habit, consuming lots of coffe in the morning is a bad habit so in this master thesis we will show how habits affect our lives, and more than 40% of our lifetime relays on habits and how we can use wearable technology to improve our bad habits, also we will go through process of creation of a device that correct habits which is Hip (Habit improve police). Hip is a fusion sensor device that can be weared and prevent obesity, smoking, alcool consumption, it can track heart rate-measure your heart beats, also detects monoxide carbone in nature that is very harmful for our oganism easy to carry; hip has ability to motivate users to change their habits by punishing them if they use something unhealthy for their organism this exstra function called “shock ray”except those hip would have long life battery and easy carry, anyone can wear.There is no particulary target audience for hip, who thinks that have a bad habit and know how controll device can use hip to improve their habits no matter their age, marital status, nationality, hip is open to all. It is easy to use. Anyone who has smart phone can use it without knowing special things. A Motivation word that hip founders use is “dear to change” basically if you want to change your lifestyle this is your opportunity .

Keywords: Habit improve police (HIP), Wiling to change habits, sensor, device, The habit loop, wearable devices.

Hypothesis

For purpose of research we will give some hypotheses that along master thesis we will prove while they are successful or not. Hypotheses are as follows:

1. Proving that wearable devices can improve our habits

2. Information that is collected from the system represents true state of the user's organism.
3. Proving that HIP system will be able to replace bad habits into good one

4. HIP will be able to operate in real time with online server that we have planned to implement, in order to have a clear review of users organism.
5. The device will be efficient and friendly environment.

6. During the process of assembly we will be able to implement all system sensors that we have planned, in any case that we cannot implement all we will try to implement at least three of them.
7. Hip system will give proper motivation to users.

1 INTRODUCTION

Being in a bad shape nowadays is random for many people many of them suffer from obesity and other from thinness, others suffer from diabetes and other from hear decease In a study conducted by Global Burden of disease & the Lancet,2014 reveals that around 65% of all deaths caused in the world are caused by heart disease, heart stroke, heart failure [1]We cannot prevent death from happening but we can make to live longer with proper care for our self, eating healthy,exercising, living in healthy environment and soon. but it is very hard not eat fastfood when our time in work is overlong, we cannot exercise because we are tired of working in other words it is very hard to get motivated to improve our habits. Another scientific study shows that diabetes has been noticed more and more in young people 20 years older with 28 million youth people than elders 44 to 65 years due to obesity and stress Obesity is a result of a bad eating diet, mostly because of junk food that young people love so much2]. Recently I have been designing a device that can be used as a secret motivator that helps people that want to change their habits by constantly watching over them and reminding them when they are doing something that they should not be doing.HIP (Habit Improve Police) device[i] improves their overall wellbeing and contributes to the way people see bad habits and raises their self-awareness. It presents a powerful and flexible technique to replace bad habits into good one due to its functionality that captures latest technology.

Due to replace bad habits into good ones by hip you should be a bit self-motivated and determined to do so. According to Maxwell Maltz the plastic surgeon habit can be broken from 21 to 254 days depends on method and tools used, [3] but in our case we will use method used in a habit changing device called Pavlok that they use only Five day to change your habit with help of Shock ray, that this sensor is also included in HIP device 4].Due to its functionality hip should undertake some activities to grant a good user experience with some sensors that hip poses it will monitor users heart rate while heart rate is in under or normal condition and warn user with tone from buzzer, vibration, or small amount of electricity that I prefer to call it Shock ray. All those warnings will be undertaken according user specifications.

Another important activity that is used in this system is friendly environment notification. To fulfill main criteria of research this system we have endowed with some air pollution sensors that their sensitivity can be adjusted according users specifications that smells while ambient is proper for user or not, depending on settings that user selects, system always warn it for surrounding environment while it is good for it to stay in that ambient or not. Also system will include mapping of data and put those location online that other people see while is good going in those places or not. Main case study will be focused in Gjilan, Kosovo place where I came from.

Reward yourself when you complete your daily goals or commit to a penalty if you fail, this is the following activity that is related to main topic of research, while user tries to change one habit it should identify it, determined to get rid of it and start resources that system gives as I mentioned before in this system will be integrated a small amount of electroshock. If user

is continuing ignore the breaking habit rule that he has determine to break it will push a button on wrist and get shocked by itself reminding his brain that this thing is forbidden. Except those main aim of hip device still remains into two main components, heart rate that controls your heart beats and check whether air get polluted in your environment.

With all those data that have been collected from system-sensors they will be translated into information. This information will give users a clear picture of their system, a kind of progress report that will be generated everyday and after every use moreover the functionality of device is described in next chapters.

2 LITERATURE REVIEW

Wearable devices nowadays have evolved so much that most technology have been focused on those kind of industry, the point is that any advanced technology is going to be smaller and with as many function as it is possible. For that I have decided to focus in this area. According to a report from HIS technology titled MEMS & Sensors for Wearable Report – 2014," the market for wearing device "sensor technology" is going to expand into 466 million in 2019 compared to 67 million in 2013. While shipments for those devices will be increased much more quickly, as the report reveals wearable devices are expected to increase up to 135 million units in 2019 compared with 50 million units in 2013, this warn us for a fast grown shipment of wearable devices almost three times more shipping than in 2013 [5].

To choose proper wearable device nowadays is very difficult because the market have evolved so much that it is very hard to choose one among tons of wearable device. According to Jahmes Stables article "Best fitness trackers 2015"6] most popular wearable device are wristband devices that are attached to your hands and they are categorized by operation that they can perform according to your needs if you need a tracker for swimming you can chose a device called:

- Moov now a wrist device that is attached to your leg, and track swimming activity can also be connected with your mobile phone and give more user experience also it can be used as a step count outside water.
- If you are a talented sportsman and like many kind of sports another best trackers for you might be Garmin Vivoactive, not as much fashionable device but it has GPS built in sensor that helps it to be very accurate for bikers, runners, swimmers, golf players - this is categorized as best formulate sports.
  So depending on your style and your need you can chose proper tracker for you here also I have attached some other trackers that might seem interesting to readers.
- Fitbit charger HR Fitbit is a slim wearable device that monitor heart rate and it have a step count except those it have an OLED display that support caller id notification. Second device is:
- Fitbit SurgeSame wristband with more features included all those features mentioned in the previous device but more use it friendly with a bigger OLED display, that display texts and calls also include GPS tracker. According to blog this is categorized as best wrist for running.
- Misfit Flash a device with approximately same sensors as previous device without display, which helps to have a long battery life and also it is water proof.[6]

To continue with prototyping of our device we need to know what habits are, the cycle of habit formation, can be those broken, and how many days it takes to break a habit.

A study by Duke university in 2006 conclude that habits might be good for us according to their research 45 percent of what we do today is habit, or automatically programmable to

our brain for example we just grab a cookie without thinking. According to this study automatically habits can happen in a specific time of the day under specific condition [7]

There is a cycle of that forms habits in CharlsDuhigg in his book “The power of habit” [8] he has elaborated birth of a habit independently good or bad, it says that habits are formed into tree steps first cue, routine, reward. Cue is taken as a trigger that puts you in some actions, routine is explained as something that you do repeatedly and reward is considered the benefit that you earn after satisfying your needs. Assume that if we drink a glass of water every morning it will cause decrease in weight. That moment when you decide to drink a glass of water in every morning you put in mind that you have to do that is cue, then you drink it repeatedly that is routine, and after you have lost weight from drinking water it is reward.

Will of people to change can be expressed through the following experiment by psychologist Roy F. Baumeister1998 [9], it proves that after taking some students and giving a list of forbidden things that they should not do by the time they are eating, searching in the Internet and as a result they conclude that ego can be expressed same as will but with practice we can improve our motivation. This experiment gives a proof that we can practice our will and motivation and trying that our finished product will be treated in this thesis will not be only tracker but to be a good motivator, too.

According to BJ Fogg, Lacking of a method where to start is the main key that demotivates people and finding that doing small things first is the key to start something bigger, this research give us right information that during this thesis we should be focused into small things rather than that they might give big impact.

It is important to convince community, most of the things depends on it, it have been proven that community creates believe. According to Lee Ann Kaskutas of the Alcohol Research Group, “people might be skeptical about their ability to change if they’re by themselves, but a group will convince them to suspend disbelief. A community creates belief”.

3 PROBLEM STATEMENT

The topic of this thesis is related with the way of how to improve habits with help of technology especially by using devices that can replace bad habits to good ones. Nowadays Health problems that come from bad habits and a bad lifestyle are becoming more prominent in young people due to their lack of bad habit awareness [10] Young people usually spend this period of their age concerning their education, career, family and social life, these four key concerns leave very little time for the younger people to be concerned for their health status and they aren't aware how this could impact them in the long run.
A scientific study shows that diabetes has been observed more and more in young people 20 years older with 28 million youth people than elders 44 to 65 years due to obesity and stress Obesity is a result of a bad eating diet, mostly because of junk food that young people love so much [2] Eating junk food is just another bad habit that can be changed with proper motivation, discipline and awareness. Recently I have been designing a device that can be used as a secret motivator that helps people want to change their habits by constantly watching over them and reminding them when they are doing something that they should not be doing, by changing the bad habits of the users.

Motivation

Nowadays it is very easy to find your wrist device that can track your activity According to "MEMS & Sensors for Wearable Report – 2014," the market for wearing device "sensor technology" is going to expand above 400 million in 2019 compared to 67 million in 2013, [5] Due to this fast grown technology of wearable devices I find motivated to be a part of big market for those small sized device but instead of that, those are just tracking device. Will they perform any other functionality except only tracking and measuring? We cannot know yet. I am making this thesis to prove that we can use wearable devices as secret and personal motivator by implementing proper technology.

4 HABITS IN EVERYDAY LIFE

The are many rumors that say “humans are creatures of habit” so it seems to be correct as we have seen so far, we might say that life is only a set of actions that have become routine [1] By defining a habit we should start from everyday routine at that moment when you wake up. Do you wake up fast or hanging on bad slowly? What is the first thing you do? Do you grab your phone and read emails, or access on social media, after you wake up? Do you first brush your teeth or drink coffee? How you tie your shoes, which foot takes priority left or right, with which hand do you open your car door? This is only a brief review of how you start your day based on habits in a study by Duke University in 2006 conclude that habits might be good for us according to their research 45 percent of what we do today is a habit so if we live 100 year we will relay our 45 years of our lifetime on habits [2]

Habit formation and their psychology

It is important to know that we are born without habits, habits are formed through life, in the beginning habits are consciously but if we frequently repeat an action then this habit becomes automatic and unconsciously we depend on it, just to remind previous example of morning wakeup, after we wake up we decide whether we should grab our phone first or go to wash our teeth, if we repeatedly grab our phone in the morning and read mails and messages it becomes an automatic habit. Thinking in generally habits are not a bad thing, they free up our time by putting our organism in automatic mode that we can think different things while we are performing a habit, but main problem here stands on bad habits and our main goal is to deal with them [1].

The habit loop

Habits are divided by their complexity: Simple habits are when included some simple actions that require small attention, when we need to choose with which hand we will open our car door with left or right, and as complex habit we will count to go into grocery store and buying something which undertake different actions, getting out from car, closing door, entering the store, finding the product. This complex habit is formed from several small actions that are considered as micro habits. Habits can be formed in three step processes which are:

Cue, routine and reward according to Putzer price winner Charles Duhig in his book: *The power of Habit: Why We Do What We Do in Life and Business*. He said that

"First is a cue, a trigger that tells your brain to go into automatic mode and which habit to use. Then there is the routine, which can be physical or mental or emotional. Finally, there is a reward, which helps your brain figure out if this particular loop is worth remembering the future."[2] Figure1 illustrated habit loop.

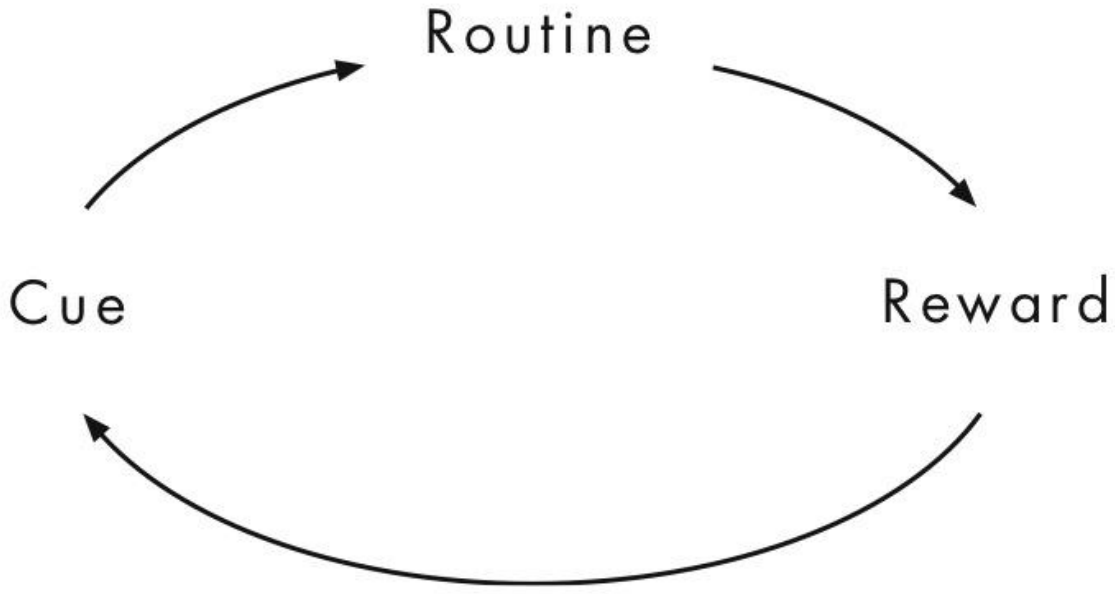


Figure1, Cue, Routine, Reward loop

Cafeteria Case

To understand how habit works, first we need to identify the components of your loop , the author Chars Duhig from the appendix to The Power of Habit states a problem of a man who every day tends to go to cafeteria and eat cookies despite his wife tells him not to go because he has already gain lot of weight, so basically man has known the component of its loop-its habit, he has found that cookies are making him to gain weight, he tried to break this habit by changing routine instead of going into cafeteria and eating cookies he walks into cafeteria with friends and grab other less sugar food than cookies, other day it gets apple the other day he only walks with friend without eating anything and there comes reward, he manage to lose weight by identifying the problem what makes him to gain weight and changes the access to that problem [3]

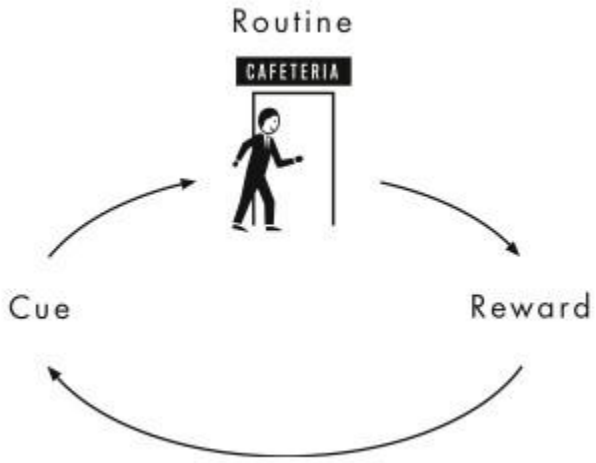


Figure 2Case of cafeteria, cue, routine, reward.

Willing to change habits

Will power is very important to undertake action to change habits but does only willpower will be enough to change habits? As psychologist Roy Baumeister said that “willpower is like a muscle” [4] it is very soft and when you undertake habit changing actions this soft muscle is not enough to perform change by itself it also required motivation. Many people don’t feel motivated in five of morning to wake up and perform yoga, if you will wake one day or few days there will be time when you say never mind I will continue to sleep couple hours more this day, so willpower and motivation in many cases have not enough strength to change habits without knowing the reward so basically when we add and reward we may have success of changing that habit.

Starting from small goals

According to Stanford psychologist BjFogg, the Fogg Behavior has three main elements which one of them is Ability. Before setting up goals it should be known that: Is there any ability to accomplish that goal, but another case is that goal sometimes is a must. There are two paths of accomplishing the goal, first case: In this case we should go through different procedures of training people, getting external resources that sometimes it is very expensive and time consumption, generally it is relatively hard. But the better path is to make small goals that you can accomplish. [5]
For example if you are trying to build a habit to improve your body shape by running by 12 Km daily, you determine when you are going to start following that program, but in the first day don't try to run 12 Km start with 2 Km then next day increase running distance by two km daily or les depend on your motivation so this smart goals wins because you start making progress and it is more easy to keep going.

Does community affect on habit change?

Sometimes undertaking a self-action of changing a habit is not enough to convince yourself but with the help of community you can reach goals what you need is only to believe that you can change a particular habit. According to Lee Ann Kaskutas of the Alcohol Research Group, "people might be skeptical about their ability to change if they're by themselves, but a group will convince them to suspend disbelief. A community creates belief."

Accountability Partners

When we speak about community we think that when you are in adverse situation and need help community will do it for you, 'to pick you up' but getting motivation to get of bad situation it is to be done by a partner: friend, family member, they are people that motivates you, so in habit formation we will arrange in groups divided by two persons to hack small habits so when a person, makes mistake the other will tell, in this way process goes through difficulties to success very efficient don't you think ?

Pavlok

During my research regarding master thesis I have review many books, scripts, academic papers and I have use different sources but finding a device that can improve habit was very hard. I have encountered few devices that are related with one or two functions that tend to correct users habits one of devices that seems more promising and more related to my research was a device called Pavlok that I will review along this thesis I also will explicate to see functionality, hardware that they have use to make this device, to review while it is really a habit changing device and to compare with my under developed system. Pavlok is a wearable device that helps correct your habits without using willpower.

Photoplethysmography

Photoplethysmographyor PPG is a technique that is used in medical devices to measure heartbeat with help of light. In any heartbeat blood vessels expanded which reduce density and allow particles of light pas through tissue PGP device detect this change, transmit to signal which we will work further with it. [6]. PPG consist LED diodes, photodetector sensor, and given electronics circuit to amplify the signal. [7] PGP measure can be performed into two methods

- Light Transmission measurements
- Light reflection measurements

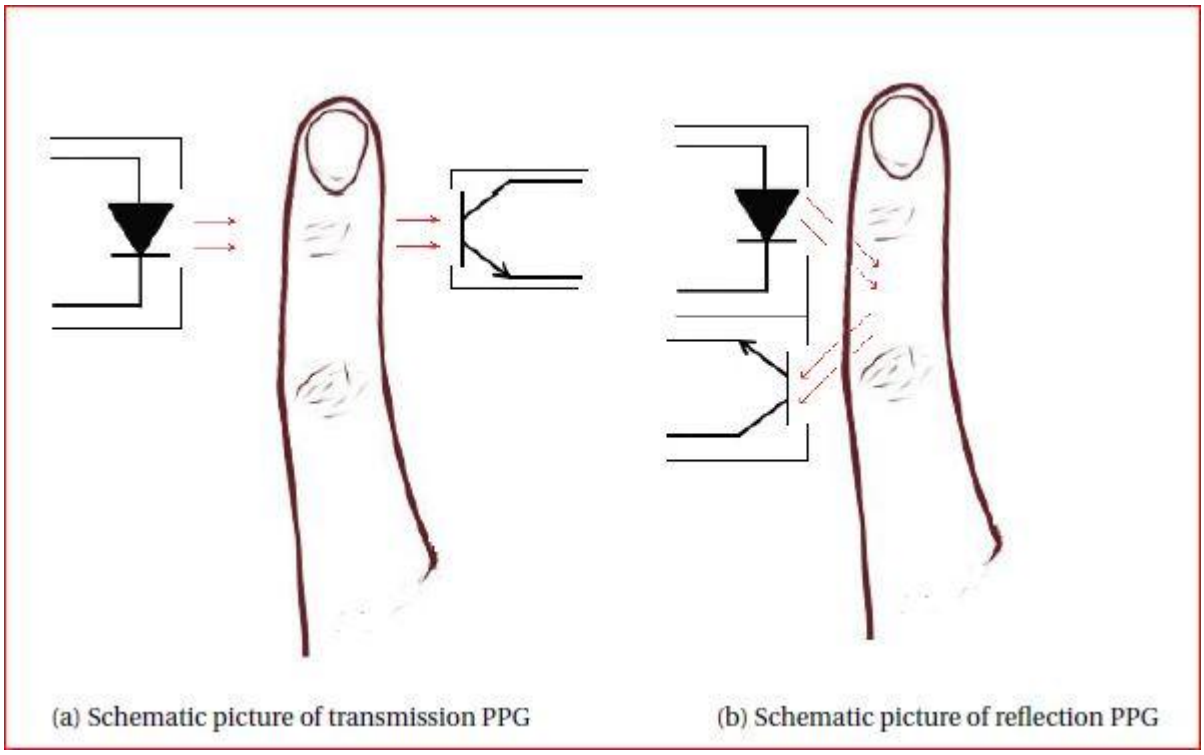


Figure 3, Method of heartbeat measurements

5 HEART RATE CALCULATION

Here I will be illustrated in figure below: R is the high peak of heart beat, IBI (Interbeat interval) and HR (Heart rate) calculation. X axis is the time in millisecond Y axis is will represent amplitude, we easy find that R peak is highest point on peak, each R wave comes after a certain amount of time so the time between two R waves is the rate of RR interval, assume that we want to measure live heart rate bpm (beats per minute) For example, if one beat (from R toR) requires 750 ms then in one minute (60*1000=60000ms), there are (60000/750=80bpm) 80beats can be achieved. This 80bpm is the heart rate against the time.[8]

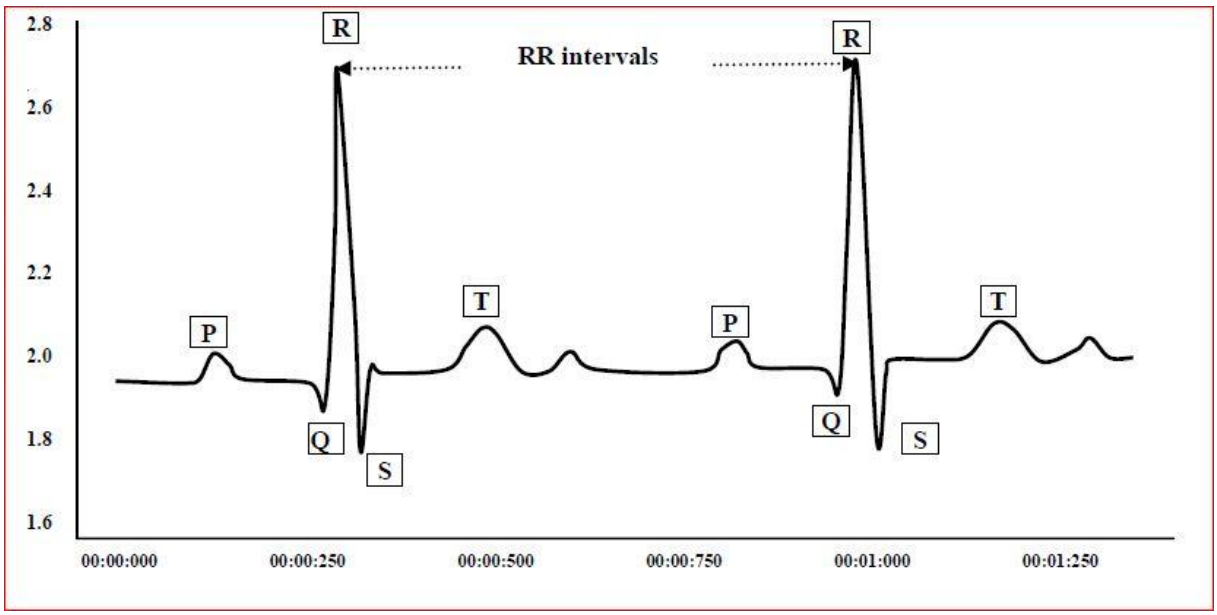


Figure 4. Heart rate caculationvisualisation

Interrupts

Before explaining how I will calculate and code heart rate monitor, I will give you a review of interrupts. What is an interrupt in term of coding? Interrupt is a kind of signal that tells microchip to stop what is doing and take something more important in consideration, this priority process is called Interrupt Handler, this function is like as any other void functions that is performed when interrupt is triggered after that process goes back to continue on what was doing before calling interrupt. Interrupts can be generated from several sources:

- Timer Interrupt from microchip timers (Arduino timers).
- External interrupts from a change in state of one of external interrupt pins.
- Pin-change interrupts from a change in state of any one of a group of pins.

Using interrupts helps people not to write loop codes that check for function priority, once when you trigger the interrupt it immediately stops what microchip was doing and calls the event handler to perform given function.
This platform that I am working on includes microchip from Atmel and Arduino programming devices, The Arduino Uno has three timers: Timer0, Timer1 and Timer2. Timer0 is a kind of timer that generates millisecond interrupt to update the counter expressed by millis().

External interrupts

As we read previously timer interrupts is performed by internal code, unlike external interrupts are triggered by external sources, pressing of a button can trigger external interrupt.

Pin change interrupts

By manufacture Arduino Uno has only two external interrupt pins, but there you can customize eight pins to perform interrupts by “Pin Change Mode” the complexity comes when you have given interrupt code to all eight pins and you have to save each ones state to, determine from which pin interrupt signal is given. [9]

6 CLEAN AIR

Clean air is basic requirement for life, quality of air inside, school, rooms, office and public building is an essential determinant which people health directly is affected. Indoor air quality is mostly affected by hazardous substances that emitted from building itself, furniture, construction material and all indoor inventories. Main pollutants that are common on our ambient are (benzene, carbon monoxide, formal dehyde, naphthalene, nitrogen dioxide, polycyclic aromatic hydrocarbon) [10]

Benzene

Is considered one of the pollutant that is present in both outdoor and indoor air, in which outdoor is less concentrated than indoors, it is also considered as genotoxic carcinogen in humans and no safe exposure can be recommended

Carbon monoxide

Exposing to carbon monoxide can lead to depression in people and cardiovascular disease. Based on laboratory studies reduction of exercise capacity in people which have cardiovascular disease it was determined that Carboxyhemoglobin (COHb) should not been exceed level 2% .levels of COHb is a measure of the degree of carbon monoxide (CO) exposure the source of the CO can be exhaust from (Car, trucks, boats, generators). According World health organization in 2009 epidemiological studies shows that appropriate guideline level for longer term average concentration of carbon monoxide" in order to minimize health effect must be positioned below 8 hour guideline of 10 mg/m^{3}also another series of indoor exposures is recommended as follow 100 mg/m3 for 15 minutes and 35 mg/m^3 for 1 hour (assuminglight exercise and that such exposure levels do not occur more often than one per day); 10 mg/m^3 for 8 hours (arithmetic mean concentration, light to moderate exercise); and 7 mg/m^3 for 24 hours".[10]. "In normal condition CO can be found in nature, in this composition "At 760 mmHg and 20 ^{o}C, 1ppm = 1.165 mg/m^3 and 1 mg/m^3 = 0.858 ppm; at 25 ^{o}C, 1 ppm = 1.145 mg/m^3 and 1 mg/m^3 = 0.873 ppm" in which ppm (is part per million)".

7 MEASURING LEVEL OF CO IN INTERNAL AMBIENT

Knowing that Co is very dangerous and toxic gas that we can find into our internal ambient, we should undertake action to avoid contact with this deadly gas, but first we need to measure gas concentration, here is a guide on how to measure carbon monoxide gas concentration in our internal ambient. There are no standard so far that determine the air quality for non-industrial indoor, U. S. EPA has set National Primary Ambient Air Quality Standards for Outdoor Air to be used in locating ventilation sources to build this standard is said that exposure on CO for 1 hour can be 35ppm, but only once in a year, or 9ppm over any eight hour period. After we know the limits of presence of CO we can practice our measurements, samples of air are taken in any part of inner-ambient to make sure that we have proper samples, special attention we should give to places such smoking areas, garage and devices such are boilers, stoves measure is performed in real time with IAQ (Indoor air quality) devices and gas sensors.[11]

8 HIP DEVICE

Hardware

Hardware components

Smoke sensor

Human being need a regular supply for food water and air according to World health organization for one day people should inhale 10-20 m^3 of fresh air and drink 1-2 lit of water. (World Health Organization, 2010), opposite process of inhalation is exhale after absorbing oxygen we exhale dioxide of carbon which is close related to monoxide carbon but less dangerously to human, each one should be with a proper mass in environment even absence or presence in critical ways can cause damage in our respiratory system and more but most deadly gas that we can inhale every day is Carbon monoxide (CO). It is produced by burning material that mainly composite is carbon which proves that after people smoke cigarettes they release CO and if there is a great density of it in a living environment it might be very harmful for living organism specially for humans. Monoxide carbon can be considered as the "Silent killer" so called by New York State Department of Health because it is invisible easy inhaled and very dangerous [21]

Referred to ASHRAE standard 62.1-2013 air pollution level indoors cannot be more 35 ppm (part per million) for one hour average and nine ppm eight hour average [22], we can referred parts per million as one monoxide carbon per one million parts of air, ppm can be converted into $mgCO/m^3$ (milligram carbon monoxide per meter square), which 1ppm of CO is equal to 1.15 mg/m^3. In a study shown that exposure to carbon 0.36mg/ m^3 for four hours can cause changing of eye blink frequency also have been proven that main cause for heart failure, heart attack, is non-stability of CO in blood and in air (World Health Organization, 2010). In hip device I have integrated MQ-2 Gas sensor, very sensitive sensor it can detect air pollution with many composition like I-butane, propane, methane, Alcohol, hydrogen, Smoke, knowing that the carbon monoxide (CO), here is presented schematic of MQ-2 Gas sensor.

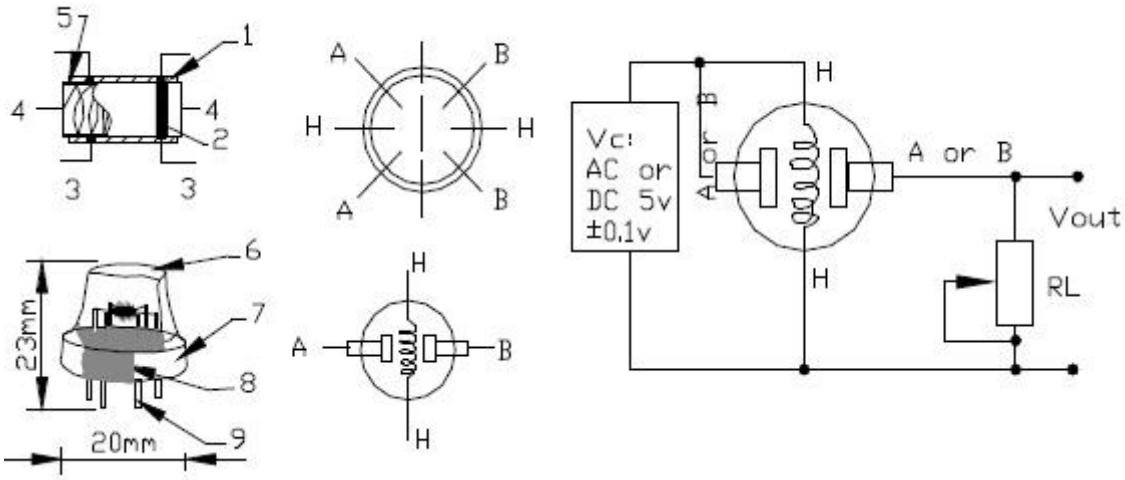


Figure 5 Smoke sensor schematic, front, back up and down view.

Heart rate sensor

In a study conducted by Global Burden of disease & the Lancet, 2014 reveals that around 65% of all deaths caused in the world are caused by heart disease, heart stroke, heart failure[12].Based on this fact we might say that heart disease is very spread over the world. To spare our self from getting sick we should undertake self care and to be careful what we eat, drink do we have enough sleep, do we exercise and so on. Another indicator that tells us that heart is in a good condition or not, according to American health association before learning to calculate your heart rate you should know your "resting heart rate" which is the number of heart beats measured while you are resting it usually preferred to measure in the morning or before going to bed.

According this organization heart rate varies depending on many factors that are age, your current state while you was doing activity or resting. Heart rate for children older than 10 years and to elders' heart beats vary between 60-100 beats per minute excepting trained athletes that their heart beats vary from 50-60 beats per minute this means that everything between those values is in normal but if we exceed those values it will be dangerous for our health.[13] based on those statistics we should keep a standard heart rate and here comes HIP device with his heart rate sensor which technically is prepared to measure your pulse while is attached close to your vessels.

Sensor itself is designed in heart shape, it have one light source this case manufacture have used Led diodes to emit light, and a photo resistor also a controlling chip and some energy source regulators.

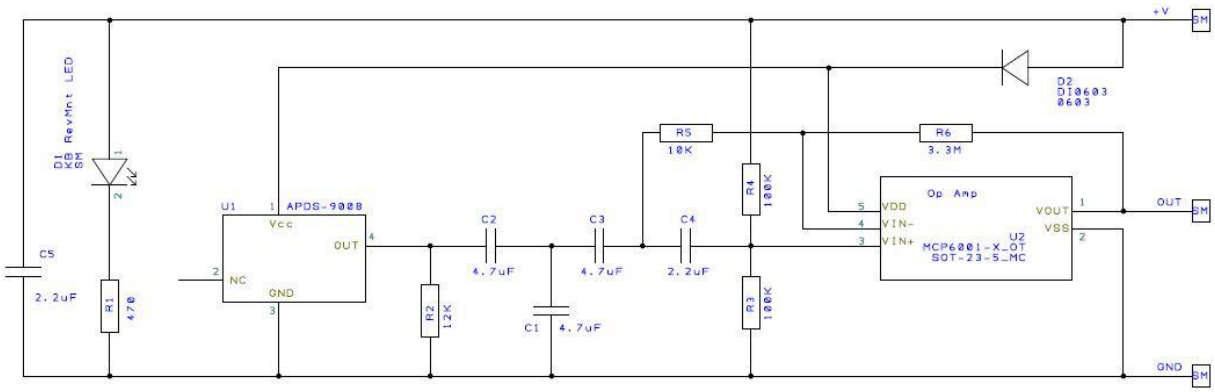


Figure 6 Heart rate sensor schematic.

In this schematic we see different of components mentioned in previous section, all parts are correlated between each other that grant a good functionality. By placing this sensor close to our vessels the led will be bright automatically and also photoreceptor, by changing the mass of blood into our vessels which is commonly by heart beats, photoreceptor senses and gives a signal to chip and chip than decide that it was a heartbeat

Screen

To be more user-friendly our device we decided to implement a 0.96” inch Oled Display to show tasks that we are running currently or we will run on hip device, it is a smart Oled display manufactured in Taiwan by Univision Technology Inc. Display have 128x64 pixel that grant basic quality to view characters and 2d figures and bitmap images I chose this display because this display meets criteria to be placed into our device because it is low consuming energy operates in 3.5 to 4.2 Volt[14]

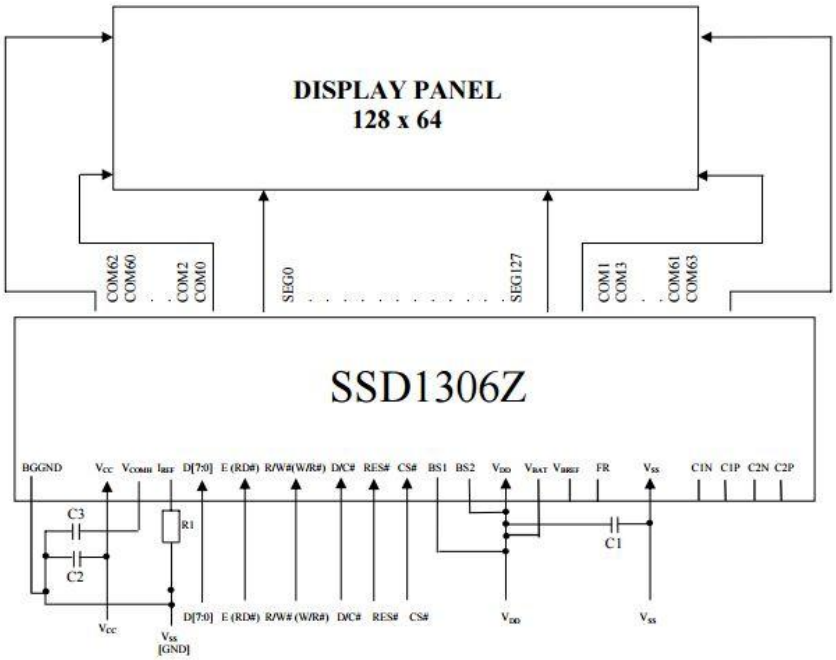


Figure 7 - implementation of 128x64 display into SSD1306Z Microcontroller

Battery

Power source in many small electronics component is battery it vary by the device size, for what is device used for and soon. Well considering that our device is wearable and relatively small, I have decided that battery to be small and compact with device a kind of battery suitable for device function. I have implemented a 3.7V 230 mA small thin lithium ion polymer rechargeable battery known as (LIPO or LIPOLY), it is a very powerful and light, which contributes to hip device not to weight too much. Considering battery power of 250 mA hip device can run three days with a charge but it depend on use of hip device.[15].

Bluetooth

To grant communication between hip and server we have use Bluetooth connection, among many technologies we have chosen it because it is low power consumption technology that is widely used as PAN (personal area network), very secure and stable. In our project we have implement HC-05 module which have a range of modulation from 2 Mbps - 3 Mbps which has build-in a 2.4 GHz antenna with digital wireless transceiver that can be changed between master and slave and vice versa, module operates between 3.1V - 4.2.[16]

Central Processing Unit (CPU)

In hip device to accomplish all tasks we have implemented required a stable and low energy consumption CPU. According to all tasks we have concluded that ATMEGA328p processor TQPF standard (7mm x 7mm) is suitable for our project, small size, low energy consumption and enough to handle system tasks, it have four sectors by 8 pins in each 32 in total with 32 general purpose working register which are connected directly to the Arithmetic Logic Unit (ALU) real time counter with separate oscillator with32K Bytes of In-System Programmable Flash program memory. 1K Bytes EPROM and 2K Bytes internal SRAM, operates between 1.8V to 5.5V with a very extreme temperature range -40°C to 85°C with a lifetime 100 years at 25°Cthe optimal temperature. For everyone who is interested we will provide block diagram of this chip architecture.[17]

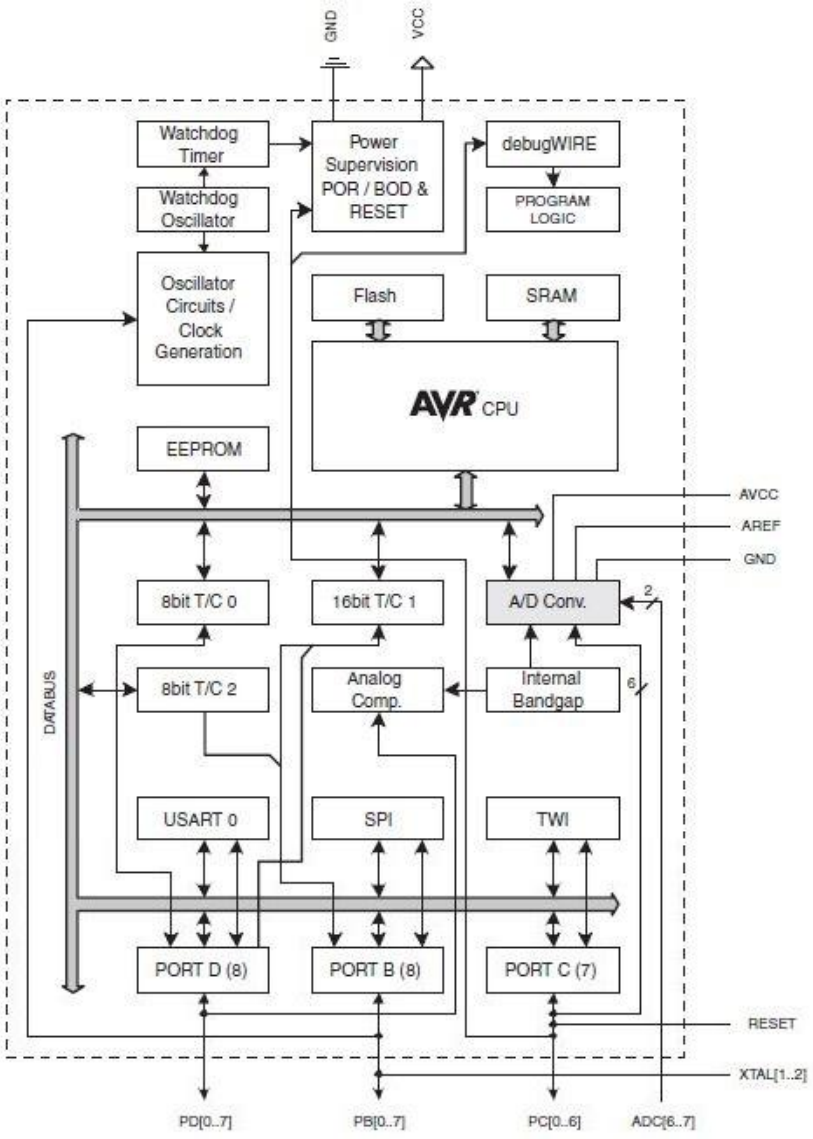


Figure 8, Block diagram of ATMEGA 328 TQPF

Entire system schematic

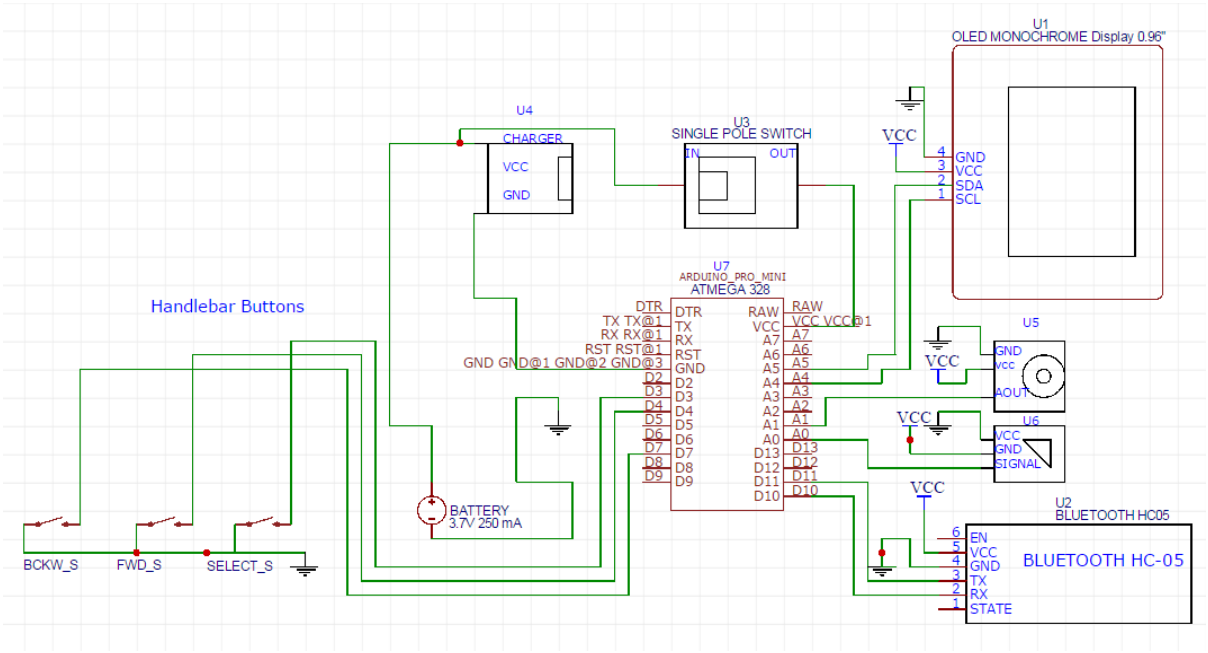


Figure 9, HIP hardware system schematic

This is schematic for hip device, here I have joined all parts together and visualize their connection over pins. In this scheme I have used eight main components of entire system but you can view each components schematic by itself in above sections. As a main unit is Arduino pro mini, followed by Oled monochrome mini 0.96 inch display, heart rate sensor, smoke sensor, Bluetooth unit, charger unit, button for navigation on program and battery. Entire system is wired by bus connection in this case is copper wire and joined with tin in each node. Main board is composed with a microchip Atmega328, 3.3v version, proper for my project according that system require graphical processing we use this monochrome organic led display blue and white color connected to our board by using two analog pin of boards A4 for SCL and A5 for SDA display runs on 3.3v to navigate over program we have use three push buttons one is for selection two others are for up and down navigation as input we have used negative so defined in programming code, used pins for navigation are D3-forward, D4-select and D7-backward. According Bluetooth unit we use HC-05 module, which consist four main pins two for power supply GND and VCC and two other RX for receiving data from microcontroller and TX to transmit data into controller if there is any, two of transmitting pins we have connected into separate pins pin 10 for RX and 11 for TX. Heart rate monitor is based on light sensing technology as I have mentioned before how sensor work, it have three main pins two for power supply same as other module and one to transmit signal from sensor to main unit that we have grant communication over A0 analog pin. Unit 5 or U5 is sensor that sense smoke in surrounding environment we have grant communication with main unit via analog port A1, we also have two separated components that work independently from main unit they are: Rechargeable battery unit which is 3.7 250mah and charger circuit joined with a mini USB charging port also two light indicator that track charging status.

Software

Android software

Hip mobile phone software review, considering that our software will be developed on Android platform we adapt, view and function to given framework here we will show main functionality of software illustrated with picture and description

Figure 11 , Icon of software and access on it

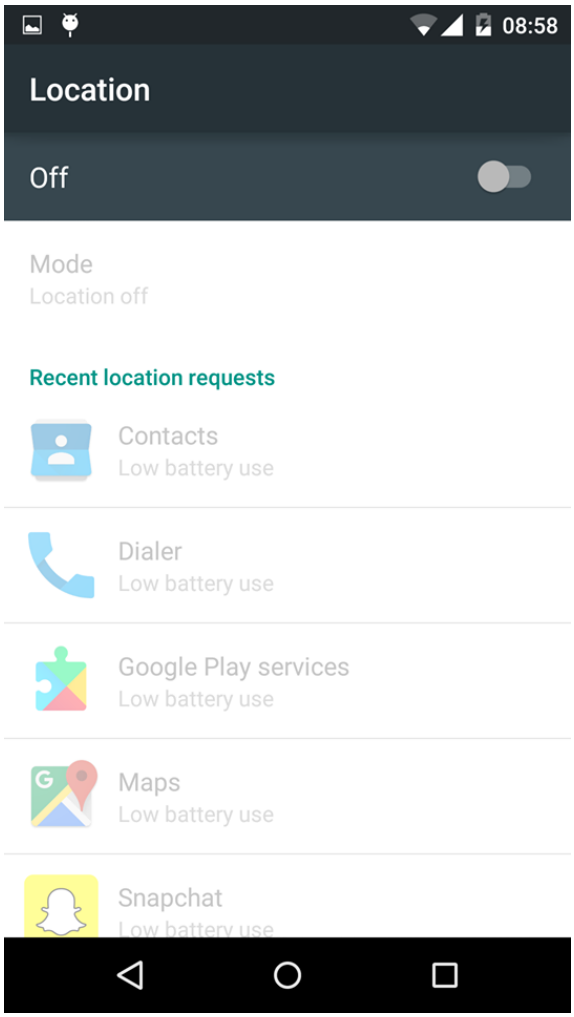


Figure 10Ask for permission to access location

To grant a good visibility to the application we have designed a square light color icon that we can access into application from given form, after we have clicked into icon automatically application will display a splash full screen activity written “HIP” to identify the application name, after that application will redirect to a very important function that we have determined, it will check while application is getting GPS (Global Position System) data. If this service is disabled automatically, application will redirect to phone settings while you can switch geo location on.

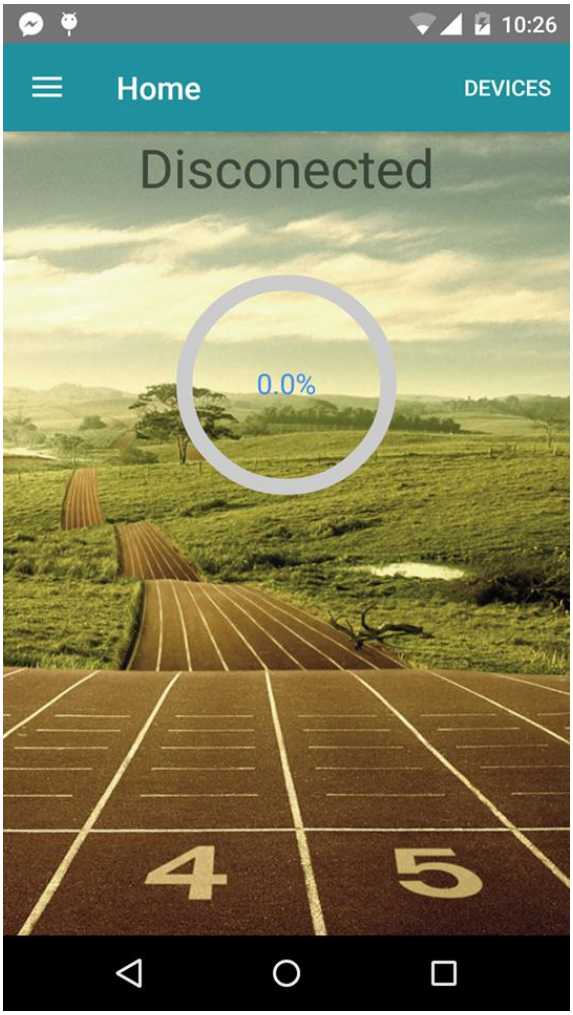


Figure 13 , Application main activity

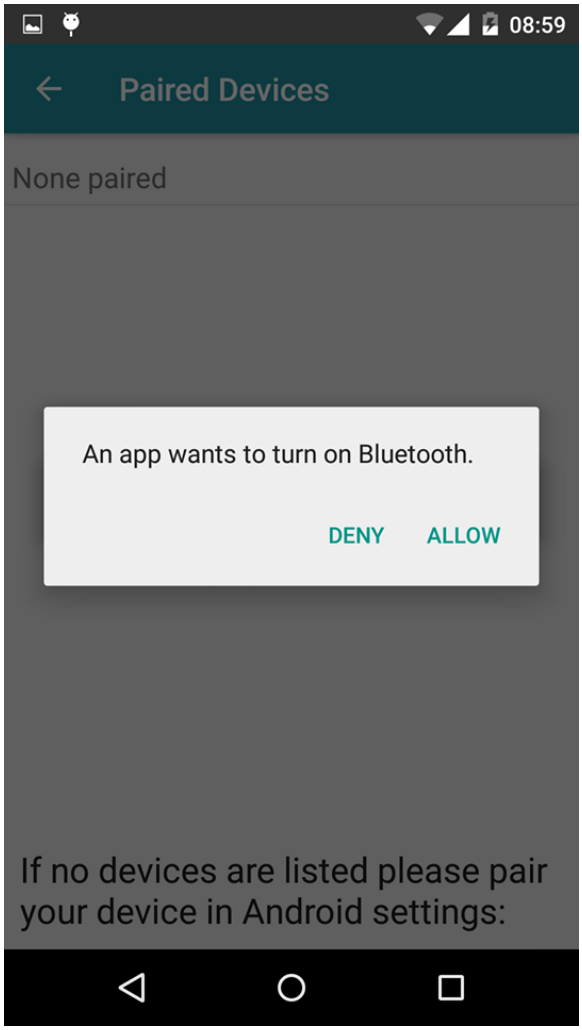


Figure 12, ask permission to access Bluetooth settings

After application is granted access into geo location over phone Gps radio, it is ready to move to main activity, that from here it can access into all application settings and data, in main activity we see two main buttons located into left up edge and right up edge of display first menu is “HOME” different is “DEVICES” into home menu we will display a fragment-animated menu that we will illustrate in next picture, in other menu we see all external Bluetooth devices that previously we have paired with mobile phone, in our case we only will have a device named “HIP, but after we access into “DEVICES” menu application will check while Bluetooth is activated or not if not a pop up menu will appear and ask to enable or deny Bluetooth service.

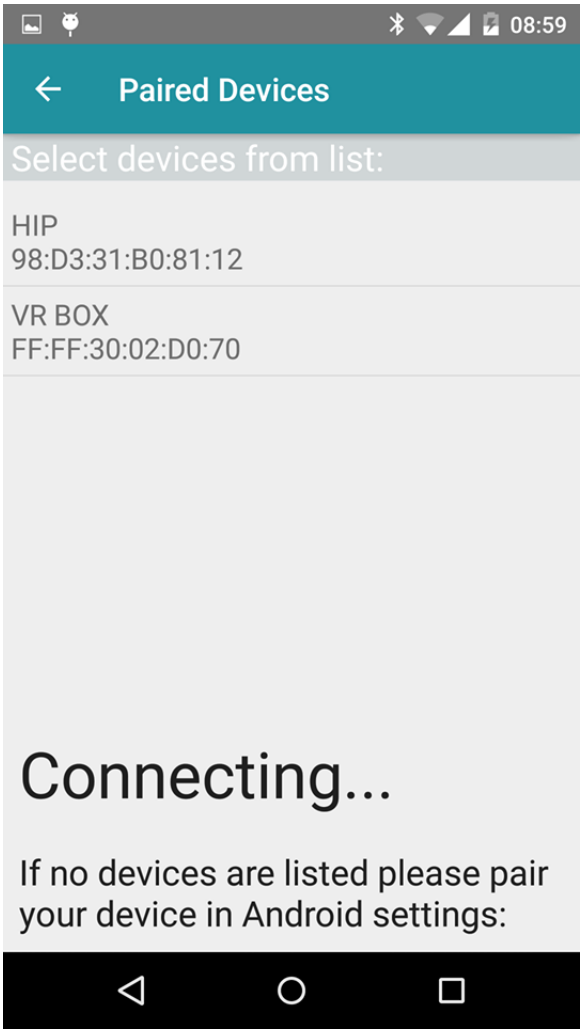


Figure 14 , Bluetooth device list

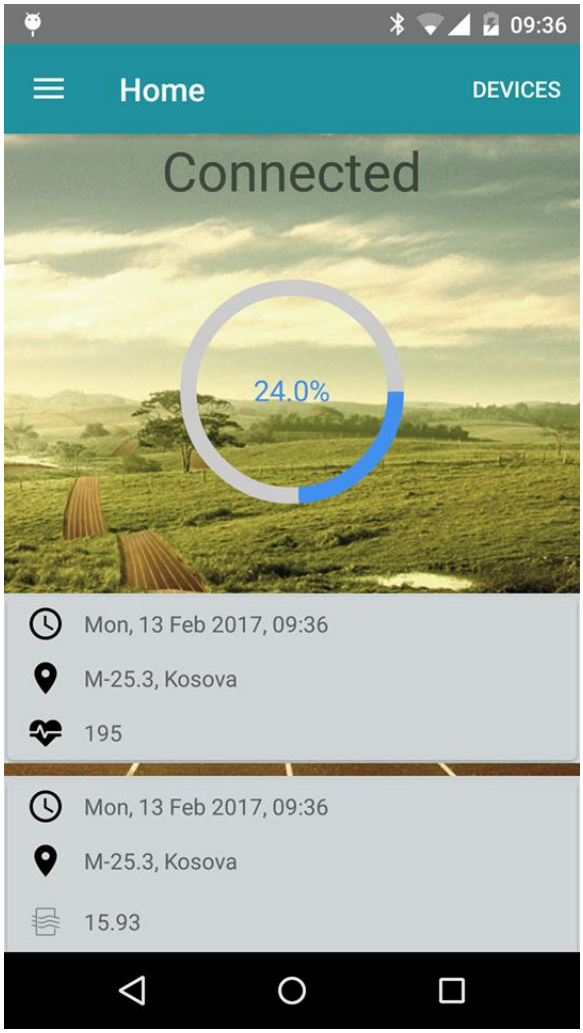


Figure 15 , Receiving Bluetooth data

We grant access Bluetooth module by allowing its services a list of all available devices will be displayed, in a list row is composed by two data, one is device name which in our case is “HIP” and Mac address of device which in our case is “98:D3:31:B0:81:12” so we click on our device, and a message will show that device is connecting, after connection application will redirect to main activity which is composed of a progress circle bar that show that data are being received, also a status message will appear to say that device is connected, while status is positive and data are being received , a two row list will be displayed by giving us real time data from given options that we have optimized in Hip device, in our case we have set 2 data to communicate with application which first is heart rate, and pollution activity, also in each row is displayed place on which are measurement being held on, this progress bar will pass 30 seconds, into next measure during this period of waiting all data that are collected for 30 seconds will be divided into only one value which is average of all received data for that period of time. This algorithm is being performed In order to avoid data overflow.

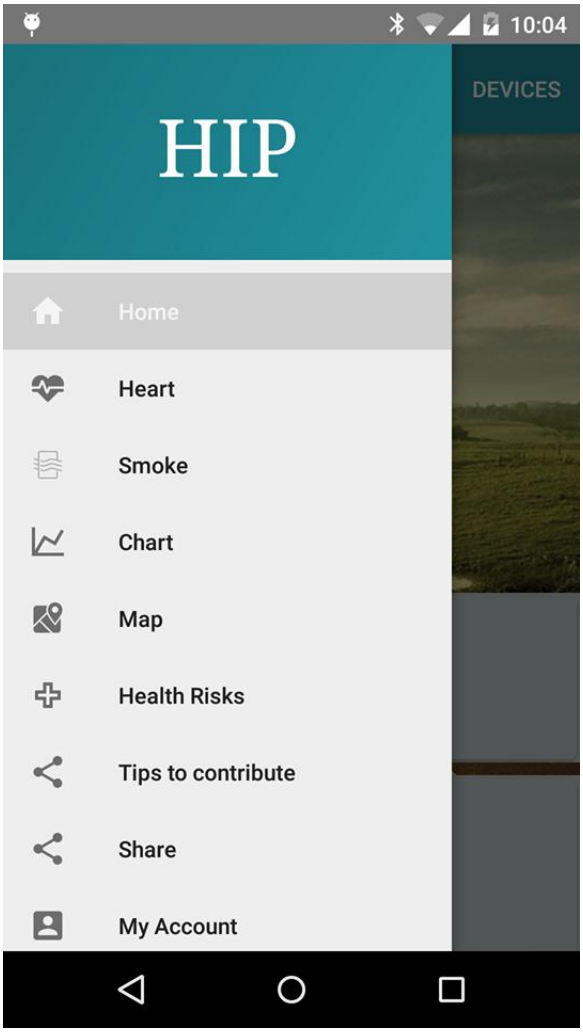


Figure 17 , Home list menu

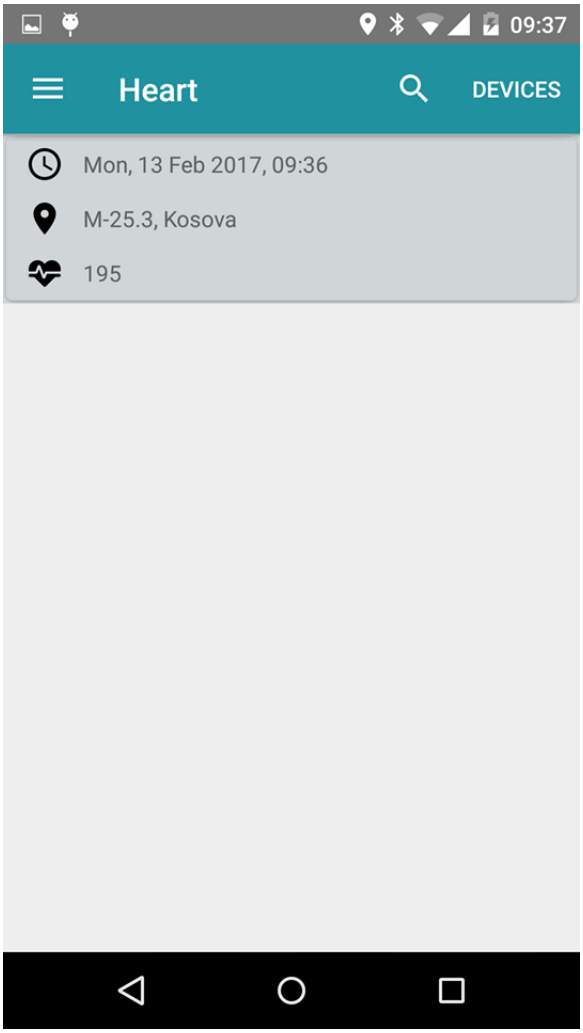


Figure 16 , Heart menu

When "HOME" button is pressed from left side of screen it will show an animated activity list which includes menu as follow: Home, Heart, Smoke, Chart, Map, Health Risk, Tips to contribute, Share, My account. After every activity if we want to return to home screen we press back button on our device or this home button in top on the list, next button is Heart with this button we go to a new activity in which is shown all data that are collected from Hip device, related to heart beat measurement, this is shown in fig 8. First record of heart beat, included time and date when also location where measure is performed, so it gives you a clear data review of result and other attributes that I mention before, followed by other menu such Smoke which it perform same functionality as previous menu but only instead measuring heart rate it measure air pollution in given area also joined with exact location and time when measurement are performed.

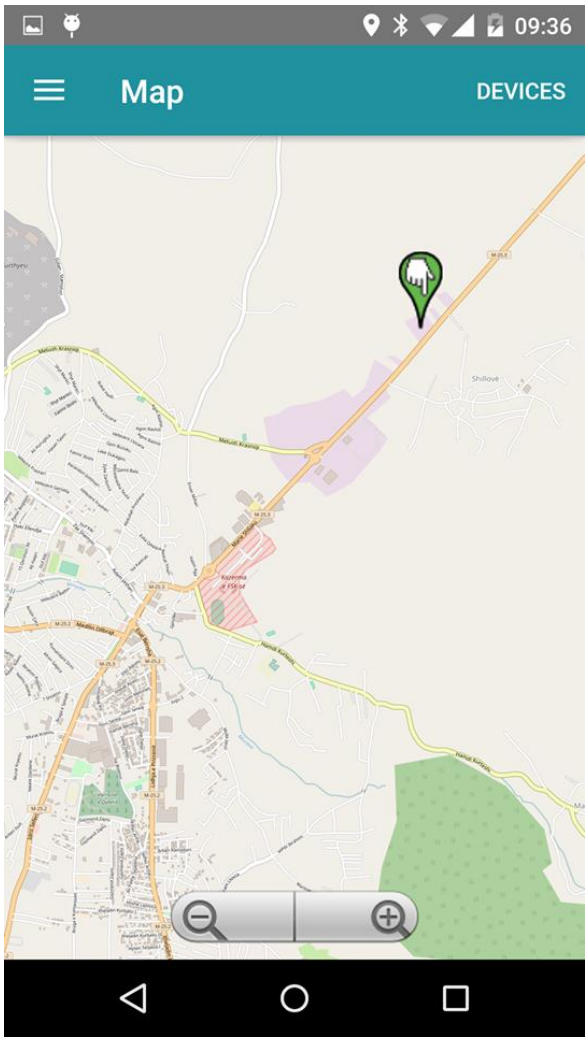


Figure 18 , Map activity

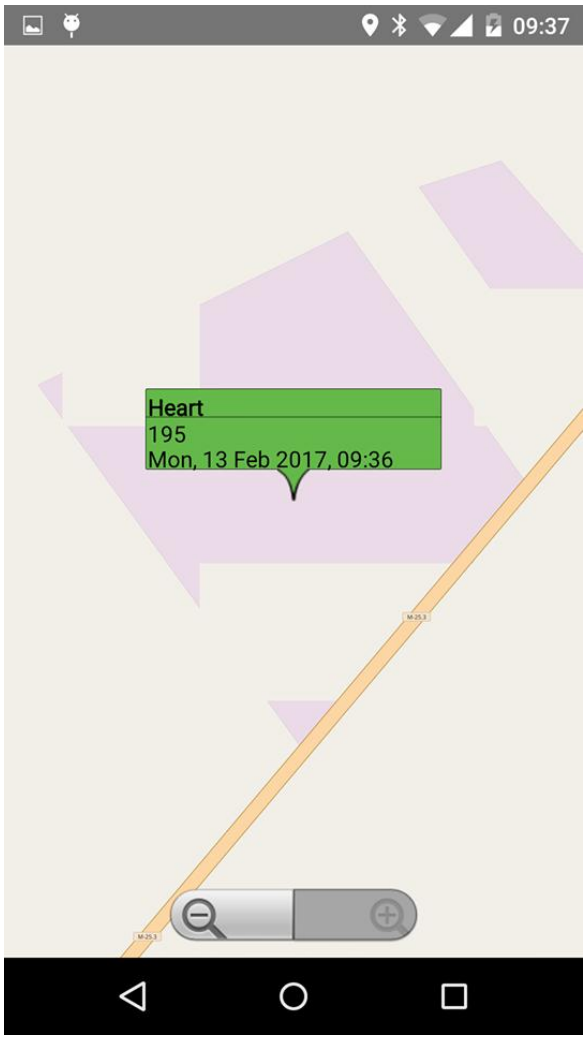


Figure 19 , Detailed marker

While we have been in Smoke menu or Heart menu we had opportunity to see rows of data with a lot of information related to place, time and real time result collected by Hip device, but there is another menu if we want to visualize our current location that measure have been performed we only click in any rows that data seems interesting for us and application immediately will send us to a map activity, and also display a marker of current place, while we can zoom in or out in map also we can see multiple markers placed in different places where we have performed measurements, also if we click in a marker that we need data without turning back to data list we get immediate result of given measurement, structure of message is illustrated in fig 10. After we press the green dot of marker its expand and show us type of measurement, which in this case is Heart then values and exact date and time.

Figure 20 , Values of pollution

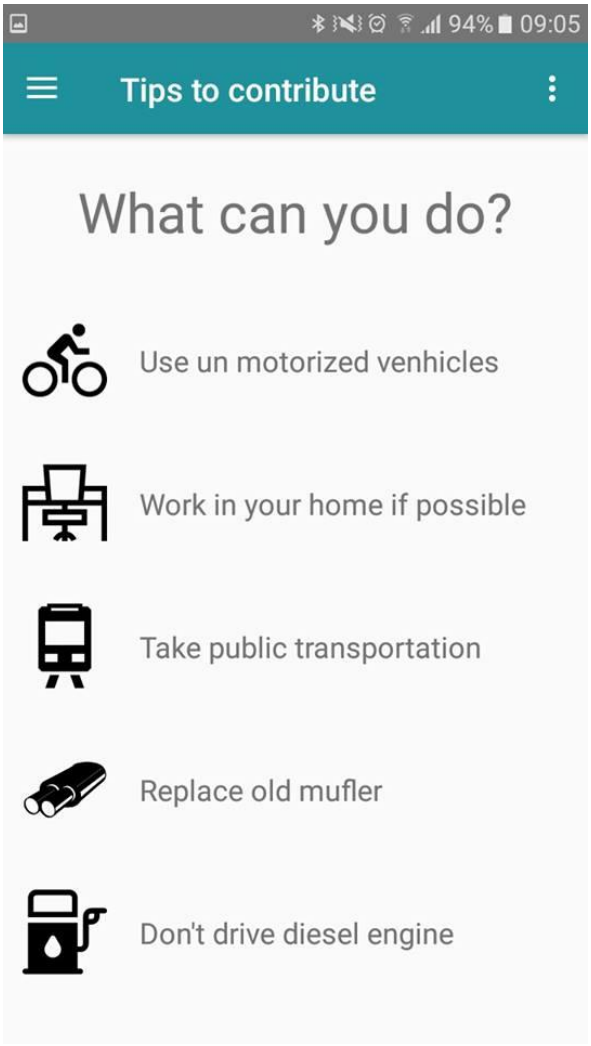
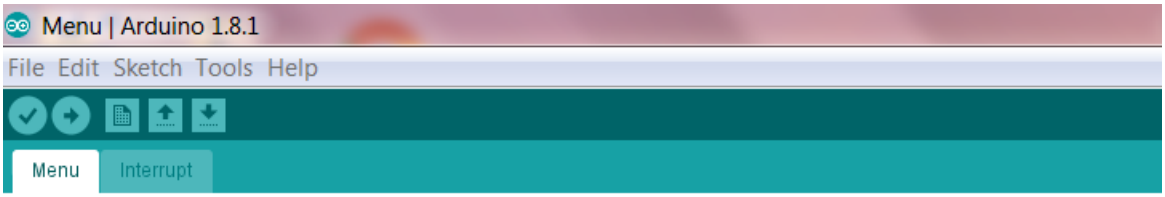


Figure 21, Tips to contribute

Under home menu we find also two other submenu “Health Risk” and “Tips to contribute” that first guide us into two extreme values, minimum pollution values and maximum illustrated with small icon that represents risk of being exposed to pollution. Second menu teach us some tips to contribute to avoid pollution and spend our health from illness.

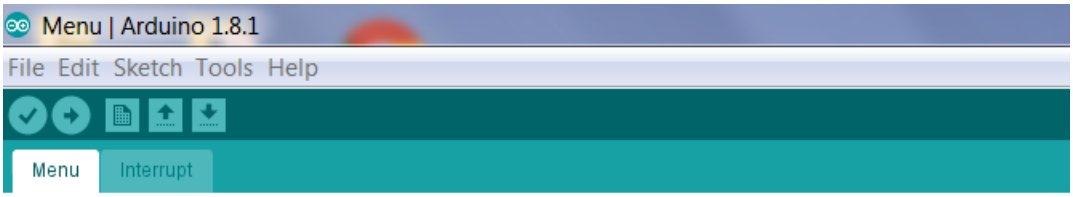
HIP device software - low programming language

The device itself is composed of different hardware part but to grant proper functionality and logic we should add software to it to make as smart as possible, in general this device is smart that in itself includes algorithm that calculates the heart rate and pollution rate on given environment, than after this comes the indicator part that displays all data into application which is powered by Android operation system, the main hardware program was made with C++ programming language and it's libraries, in Arduino integrated development environment, here I will show some fragments of code that we have implemented in hardware programming.




```
#include "U8glib.h"
#include <SoftwareSerial.h>
U8GLIB_SSD1306_128X64 u8g(U8G_I2C_OPT_DEV_0|U8G_I2C_OPT_NO_ACK|U8G_I2C_OPT_FAST); // Fast I2C / TWI

#define KEY_NONE 0
#define KEY_PREV 1
#define KEY_NEXT 2
#define KEY_SELECT 3
#define KEY_BACK 4

int rxPin = 5;
int txPin = 6,btPin=9;

bool btMode = false;
bool smodeMode = false; int somedelay=0;
bool hrMode = false;

uint8_t uiKeyPrev = 7;
uint8_t uiKeyNext = 3;
uint8_t uiKeySelect = 4;
uint8_t uiKeyBack = 5;

uint8_t uiKeyCodeFirst = KEY_NONE;
uint8_t uiKeyCodeSecond = KEY_NONE;
uint8_t uiKeyCode = KEY_NONE;

float Ro = 10000.0;    // this has to be tuned 10K Ohm
int sensorPin = 1;  // select the input pin for the sensor
int val = 0;        // variable to store the value coming from the sensor
float Vrl = 0.0;
float Rs = 0.0;
float ratio = 0.0;

SoftwareSerial mySerial(10,11);
//heart rate
```

The main class is “Menu”in this class we have declared variables and define pins for input and outputs, we have given three main switch condition to device one is “btmode” which activate Bluetooth device and makes it ready for connection to external android device the second variable is ”smodeMode” which represent menu for measurement of air quality, and “hrMode” which activates heart rate mode and sends data to mobile device, also we have define air quality measurement algorithm and convert data from analog input to air quality unit which in this case is ppm.

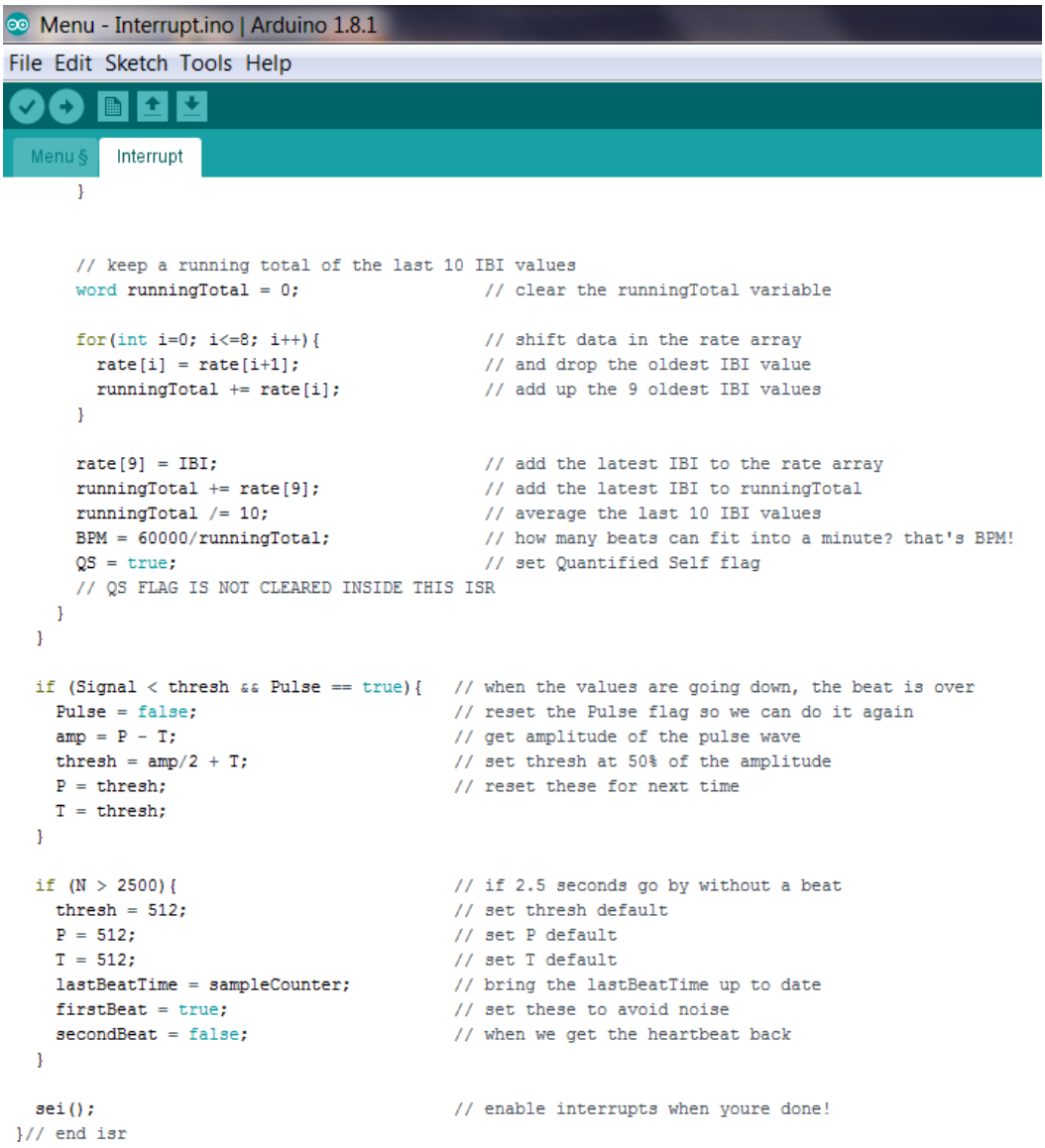



```
#define MENU_ITEMS 4
#define DESKTOP_ITEMS 3
const char *menu_strings[MENU_ITEMS] = { "Heart Rate", "Smoke Sensor", "Bluetooth", "Back" };
const char *desktop_strings[DESKTOP_ITEMS] = { "H", "S", "B" };


uint8_t menu_current = 0;
uint8_t menu_redraw_required = 0,desktop_redraw_required=0,stateView=0;
uint8_t last_key_code = KEY_NONE;


void drawMenu(void) {
  uint8_t i, h;
  u8g_uint_t w, d;

  u8g.setFont(u8g_font_6x13);
  u8g.setFontRefHeightText();
  u8g.setFontPosTop();

  h = u8g.getFontAscent()-u8g.getFontDescent();
  w = u8g.getWidth();
  for( i = 0; i < MENU_ITEMS; i++ ) {
    d = (w-u8g.getStrWidth(menu_strings[i]))/2;
    u8g.setDefaultForegroundColor();
    if ( i == menu_current ) {
      u8g.drawBox(0, i*h+1, w, h);
      u8g.setDefaultBackgroundColor();
    }
    u8g.drawStr(d, i*h, menu_strings[i]);
  }
}
```

In This other fragment of code we have defined display drivers and It's library components which is "u8gLibrary" and other parameters such font name, font position, font height and position of desktop elements that will be displayed in tiny device screen,

```
void smoke() {

val = analogRead(sensorPin);     // read the value from the analog sensor


Vrl = val * ( 3.7 / 1024.0  );      // V
Rs = 20000 * ( 3.7 - Vrl) / Vrl ;   // Ohm
ratio =  Rs/Ro;

 mySerial.print("S"+String(get_CO(ratio)));

}
```

In this code fragment express the smoke function "smoke()" with given parameters, first get data from analog sensor pin, then this data converts to Volt then add 2000 Ohm resistance divided by "Vrl" and get rati from "Rs" divided by default value of "Ro" this returns values of Carbon monoxide converted in part per million Ppm.




```
      }


      // keep a running total of the last 10 IBI values
      word runningTotal = 0;                  // clear the runningTotal variable

      for(int i=0; i<=8; i++){                // shift data in the rate array
        rate[i] = rate[i+1];                  // and drop the oldest IBI value
        runningTotal += rate[i];              // add up the 9 oldest IBI values
      }

      rate[9] = IBI;                          // add the latest IBI to the rate array
      runningTotal += rate[9];                // add the latest IBI to runningTotal
      runningTotal /= 10;                     // average the last 10 IBI values
      BPM = 60000/runningTotal;               // how many beats can fit into a minute? that's BPM!
      QS = true;                              // set Quantified Self flag
      // QS FLAG IS NOT CLEARED INSIDE THIS ISR
    }
  }

  if (Signal < thresh && Pulse == true){   // when the values are going down, the beat is over
    Pulse = false;                         // reset the Pulse flag so we can do it again
    amp = P - T;                           // get amplitude of the pulse wave
    thresh = amp/2 + T;                    // set thresh at 50% of the amplitude
    P = thresh;                            // reset these for next time
    T = thresh;
  }

  if (N > 2500){                           // if 2.5 seconds go by without a beat
    thresh = 512;                          // set thresh default
    P = 512;                               // set P default
    T = 512;                               // set T default
    lastBeatTime = sampleCounter;          // bring the lastBeatTime up to date
    firstBeat = true;                      // set these to avoid noise
    secondBeat = false;                    // when we get the heartbeat back
  }

  sei();                                   // enable interrupts when youre done!
}// end isr
```

This is the class “interrupt” that we mentioned early this class is responsible for heartbeat function, here we find declaration of variables, and algorithm of heart rate monitor, data that are collected from analog heart rate sensor, full version of hip code will be listed in appendixes section.

9 RESULTS

Habit changing results

To grant good results we have used questionnaire because they are inexpensive when they are handled properly, also they can be different types, written, postal and many other methods, these results can be included as statistical survey, they are easy to administer and manage, also they provide a lot of data manipulation the more data have been received more accurate will be the analysis, to be more specific in this questionnaire we have used structured questionnaire that this category comes into quantitative research they have definite and concrete question, closed ended question format, some of question are dichotomous questions that ask user to answer yes and no question, [18]
Habit changing device hip finally is coming up with results, until now we have collected data from two different persons and genders we tried to include best result possible by engaging this two users to hip device by giving device in use for five days in row each one separately, due to this time we had only two prototypes that was tested in laboratory and outside it and tests have been collected from two main candidates both of them have bad habits which is smoke. First candidate is ArbenVllasaliu and second is EdonaMemini, here is a deep review of questionnaire that we have made.

When we have mention that hip device improve habits we have taken into consideration to conduct some research in real ambient with a real person that want to change habits, as case study we will take another smoker in which case is also my friend Arben Vllasaliu a great person, with a wonderful carrier as a designer, blogger and painter. While he have a wonderful carrier he also want anything in its drawing and designs to be as perfect as possible, a such engagement includes lots of hard work followed with many sacrifices: Leak attention for herself not eating properly, insomnia, exhaustion, lots of traveling and soon. But except all of this a very bad habit that he had last 5 years was that he is a smoker, while we was talking and I was telling him for my research into a habit changing device he also was interested to be part of my research to see while he can break this bad habit of smoking.
According to Maxwell Maltz the plastic surgeon habit can be broken from 21 to 254 days depends on method and tools used, [3]but in our case we will use method used in a habit changing device called Pavlok that they use only Five day to change habits with “brute force” same as we have used in our device. [4]

This research will be placed in Gjilan, Kosove, experiment will start on Monday 02.2017 and end in Saturday 02.2017. Main participant in this experiment is Arben Vllasaliu and observer Granit Ahmeti. Due to this experiment participant understand that he should wear hip device and use for five days in row excluding night time while he sleeps also when device needs to charge, also he knows that hip work in “brute force” and it will

tease user in button press, so he accept all those warnings to continue with test of device.

- Considering that main goal is to quit smoking we already know that smoking is a habit that should be break.
- Second thing is that when participant catch herself smoking automatically he will press “shock button” into hip device.
- This procedure participant should repeat continuously until he reaches the best result.

After each day we have requested from participant to fill a report of how previous day was while he was wearing hip on his hand. In this report we have included different question to conclude while participant is advancing in further research, some of question included in report are as follow:

1. We want to know current status of participant of how many cigarettes does he smokes given day.
2. Next question have to do with frequency of button press, to know how many times participant press “shock” button.
3. Also in certain condition battery can be empty in short time so we would like to know how many times a day user charges device battery in which we calculate time when user removes device from the wrist.
4. Next question is how many hours participant have not use device that day
5. Pain from “death ray” so called sensor can vary on frequency of how often is used, so we ask our participant during that day does he feel pain while using device and skin irritation
6. It is common for people to carry jewelry or other required stuff with them like putting cell phone on their pocket or wearing a watch, as we know hip itself is a wearable device, but considering our care we ask whether is it easy to carry with you or difficulties such zip or unzip.
7. Also our concern is to see while our participant is carrying device anywhere he goes or just uses in particular places after that question we have added a comment section below to describe with word progress of that day.

SURVEY OF HABIT CHANGING OVER HIP DEVICE

Place:	Gjilan	**Date:**	06.02.2017
Title:	Breaking smoking habit in five day period		
Participant:	ArbenVllasaliu		

Please complete the following questionnaire with specific regard to the above enquiry, by placing a CROSS in the appropriate box [X]

	Less than 3	Between 3-5	Between 6-9	10 to 15	16 or more
1. How many cigarettes I smoked today	☐	☐	☐	☐	☒
2. How many times I press the "Shock" button	☐	☐	☒	☐	☐
3. How manyhours I need to charge device today	☒	☐	☐	☐	☐
4. How many hours I have not use hip device today	☐	☐	☐	☒	☐

	Yes	No	Little
5. Was electric teaser painful	☒	☐	☐
6. Did electric teaser cause you any skin irritation	☐	☐	☒
7. Was it easy to carry	☒	☐	☐
8. Did you take device with you outside home	☒	☐	☐
9. do you have any difficulties to zip/unzip hip device	☐	☒	☐

Figure 22, Questionnaire form user1

Comment section 1:

Today is first day that i am using Hip device 06.02.2017 i am Arben Ullaslihu citizen of Kosovo i live in Gjilan, i am designer, and i work as freelancer at graphic i think that this is the 10th year that i am smoking cigarettes currently i am smoking Winston, a traditional brand that i have smoked recently years i usually smoke 20 to 30 cigarettes daily, i know this is a bad habit, but i like to smoke it since i was young i think always have keep this temp of cigarette smoking during the summer time maybe i smoke more than 30 cigarettes a day, i usually stay up at night and study techniques of desing and update my drawing library.

Comment section 2:

Today i start with reviewing hip device to see while it can help me quit smoking, when i wake up in 9:00 AM i put hip device in my hand usually after breakfast i smoke tow to the cigarettes and i tried hip put still i smoked that amount of cigarettes later one i shocked myself tow ~~the~~ to three more times and i feel little bit pain and my skin start reading, it was ~~very~~ very easy to carry even i was not used before to take any wearable device such watch, jewelry and soon. Today, i was with friend for coffe and always device was in my hend. After some hours of using i saw that teaser was not strong on in the beginning so i tried it out to charge and let it to charge for 45 min.

Observer:

Participant:

Figure 23, Questionnaire form extension user1

In this questionnaire represent, real opinion of our candidate, ArbenVllasaliu here I have included comments that how he have described all day activity.

"Today is first day that I am using HIP device 06.02.2017 I am Arben Vllasaliu citizen of Kosovo I live in Gjilan, I am designer and I work as freelancer at graphic I think that this is the 10th year that I am smoking cigarettes, currently I am smoking Winston a traditional brand that I have smoked recently years I usually smoke 20 to 30 cigarettes daily, I know this is a bad habit but I've liked to smoke it since I was young. I think I've always kept this temp of cigarette smoking during the summer time maybe I smoke more than 30 cigarettes a day, I usually stay up at night and study techniques of design and update my drawing library. Today I've started with reviewing hip device to see while it can help me quit smoking, when I woke up in 9:00 AM I wear the device in my hand usually. After breakfast I smoke 2 to 3 cigarettes and I tried hip put still I smoked that amount of cigarettes later on i shock myself 2 to three more times and I feel little bit pain and my skin start reading, it was very easy to carry even I was not used before to take any wearable device such watch, jewelry and so on. Today I was with my friend for coffee and device was all the time in my hand after some hours of using I saw that teaser was not strong as in the beginning so I tried it out to charge and let it to charge for 45 min."

Also same questionnaire was used at the different candidate Edona Memini.When we have mention that hip device improve habits we have taken into consideration to conduct some research in real ambient with a real person that want to change habits, as case study we will take a smoker in which case is my friend Edona Memini a great person, with a wonderful carrier as a television presenter, also she leads two biggest music festival in Kosove which is "Zhurma show" and "Celesimuzikor". She has a wonderful carrier she also wants everything in her show to be as perfect as possible, a such engagement includes lots of hard work followed with many sacrifices: Leak attention for herself not eating properly, insomnia, exhaustion, lots of traveling and soon. But except all of this a very bad habit that she had last 10 years was that she is a smoker, while we was talking and I was telling her for my research into a habit changing device she immediately was interested to be part of my research to see whether she can break this bad habit of smoking. During last two years of attending to my academic study in master I was always working on my theory and trying to find new ways to test my device in someone so finally we have one candidate who wanted to challenge herself to break bad habits. According to Maxwell Maltz the plastic surgeon habit can be broken from 21 to 254 days depending on method and tools used, [3]but in our case we will use method used in a habit changing device called Pavlok that they use only Five day to change habits with "brute force" same as we have used in our device. [4]
This research will be placed in Gjilan, Kosove and the experiment will start on Monday 02.2017 and end on Saturday.02.2017. Main participant in this experiment is Edona Memini and observer Granit Ahmeti.

Due to this experiment the participant understands that she should wear hip device and use for five days in row excluding night time while she sleeps also when device needs to charge, also she knows that hip work in “brute force” and it will tease user in button press, so she accept all those warnings to continue with test of device.

- Considering that main goal is to quit smoking we already know that smoking is that habit that should be break.
- Second thing is that when participant catches herself smoking automatically she will press “shock button” into hip device to tease her-self.
- This procedure participant should repeat continuously until she reaches the best result.

After each day we have requested from participant to fill a report of how previous day was while she was wearing hip on her hand. In this report we have included different question to conclude while participant is advancing in further research, some of question included in report are as follow:

8. We want to know current status of participant of how many cigarettes does she smokes in a day.
9. Next question has to do with frequency of button press, to know how many times participant press “shock” button.
10. Also in certain condition battery can be empty in short time so we like to know how many times a day user charges device battery in which we calculate time when user removes device from the wrist.
11. Next question is how many hours participant have not use device that day
12. Pain from “death ray” so called sensor can vary on frequency of how often is used so we ask our participant while that day does she felt pain while using device and skin irritation
13. It is common for people to carry jewelry or other required stuff with them like putting cell phone on their pocket or wearing a watch, as we know hip itself is a wearable device, but considering our care we ask while is it easy to carry with you or difficulties such zip or unzip.
14. Also our concern is to see while our participant is carrying device anywhere she goes or just uses in particular places after that question we have added a comment section below to describe with word progress of that day.

SURVEY OF HABIT CHANGING OVER HIP DEVICE

Place:	Gjilan	**Date:**	06.02.2017
Title:	Breaking smoking habit in five day period		
Participant:	Edona Memini		

Please complete the following questionnaire with specific regard to the above enquiry, by placing a CROSS in the appropriate box [X]

	Less than 3	Between 3-5	Between 6-9	10 to 15	16 or more
1. How many cigarettes I smoked today	☐	☐	☐	☒	☐
2. How many times I press the "Shock" button	☐	☐	☐	☐	☒
3. How manyhours I need to charge device today	☒	☐	☐	☐	☐
4. How many hours I have not use hip device today	☐	☐	☐	☒	☐

	Yes	No	Little
5. Was electric teaser painful	☒	☐	☐
6. Did electric teaser cause you any skin irritation	☐	☐	☒
7. Was it easy to carry	☒	☐	☐
8. Did you take device with you outside home	☒	☐	☐
9. do you have any difficulties to zip/unzip hip device	☐	☒	☐

Figure 24 , Questionnaire form user2

Comment section 1:

Today is first day that I am using this device 06.02.2017 I am [redacted] Edona Memini citizen of Kosovo I live in Gjilan I am journalist I work for Zikotv. I also lead two shows "Çelësi muzikor" and "Zhurma Show". this job require lot of hard work and dedication, while iam sucessful in my profession, I also have a bad habit which is that I am a smoker, I consume 10 TO 20 cigaretes per day, which is not healthy at all, but with this technology that my friend Granit have introduced to me i will review while it can this or help me to quit smoking

Comment section 2:

Today i start with reviewing this device to see while it can help me quit smoking, my routine food include lots of coffe, lots of fast food and also cigarettes, well today i was using this device all day long as the first time as i have used such device i find weird to get shocked by myself, everytime that i smoke, cigaretes today i smoke in total 15 cigarette. and i have been shocking myself more than 10 times which i felt little pain and skin irritation, but after all it was easy to use and fast to charge.

Observer:

Participant:

Figure 25, Questionnaire extended form user2

In this questionnaire is represented, real opinion of our candidate, Edona Memini. Here I have included comments how she has described all day activity.

"Today is the first day that I am using HIP device 06.02.2017 I am Edona Memini citizen of Kosovo I live in Gjilan, I am journalist I work for Ziko TV I also lead two shows Celesi muzikor and Zhurma show. This job requires lot of hard work and dedication, while I achieve my goals and I am successful in my profession. I also have a bad habit, I'm a smoker, I consume 10 to 20 cigarettes a day which is not healthy at all but with this technology that my friend Granit has introduced it to me, I think I will quit smoking. Today I've started with reviewing hip device to see if it can help me quit smoking. My routine loop include lots of cafe lots of fast food and also cigarettes, well today I was using hip device all day long as the first time I have used such device I find weird, get shocked myself every time that I smoke cigarette, today I smoked in total 15 cigarettes and I have been shocking myself more than 10 times, where I feel little pain and irritation in my wrist but after all it was easy to carry and fast to charge."

During this period that hip device was out trying to change habits to people we have been developing and advancing other prototypes, after we have collected result from our testers we have shown graphical data then we have converted to statistics and came to final conclusion. Collected results for first candidate are as follow.

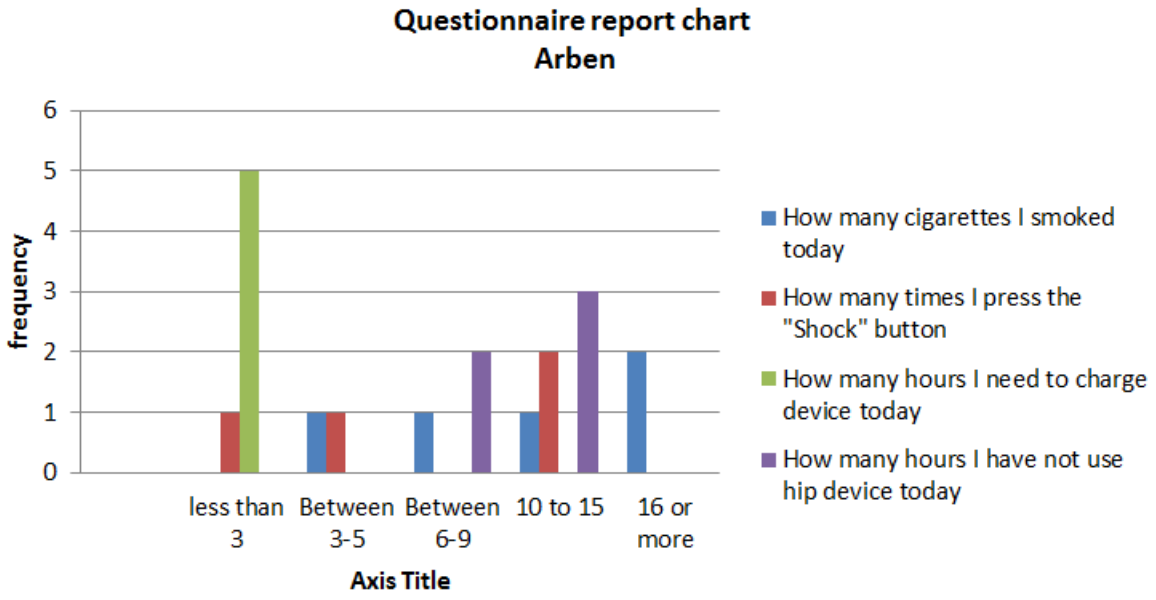


Figure 26, Questionnaire report chart Arben

This chart derive from questionnaire above referred to first candidate Arben, which as we can see there are all answers counted by frequency used, the most frequent answer that user have selected was charging the device, in five days user was require to charge device less than 3 hours, also in three days user doesn't use device 10 to 15 hours a day, in two days user have smoked 16 or more cigarettes, also user in two days have shocked itself 10 to 15 times a day.

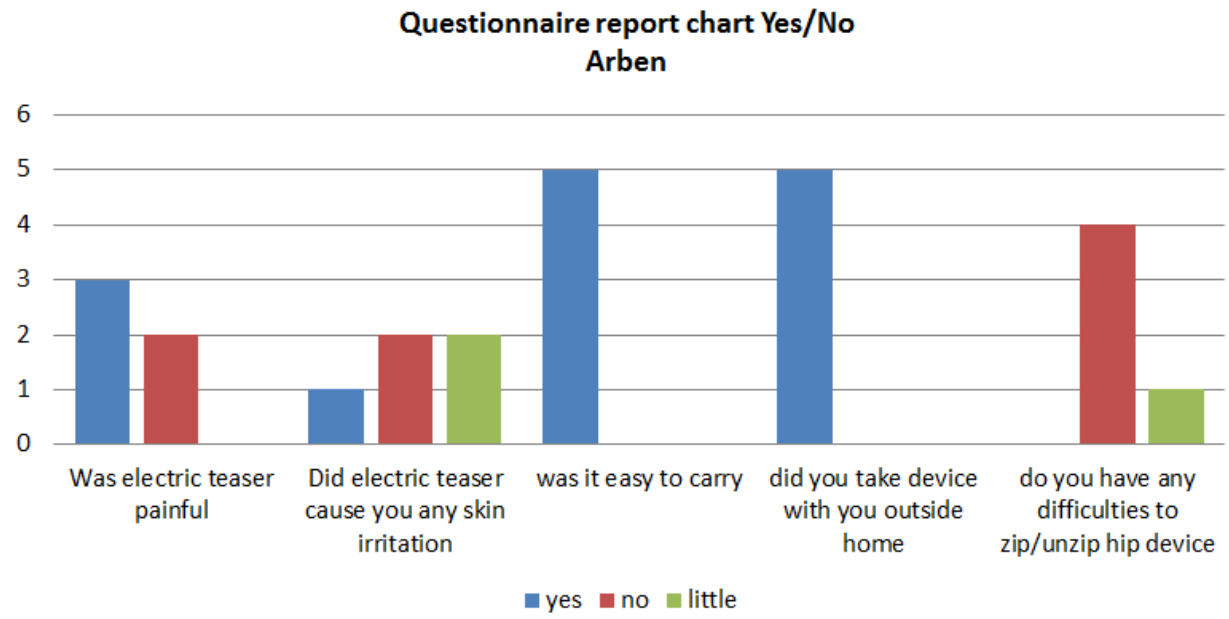


Figure 27, Questionnaire report chart yes/no Arben

The other chart represent the second part of questionnaire which was to answer three main questions that was, Yes, No, Little. At five days research user finds easy to take device outside home, also they find easy to carry, other think that was interesting that this user for three days finds painful the electric teaser, also one time user finds difficult to zip and unzip device.

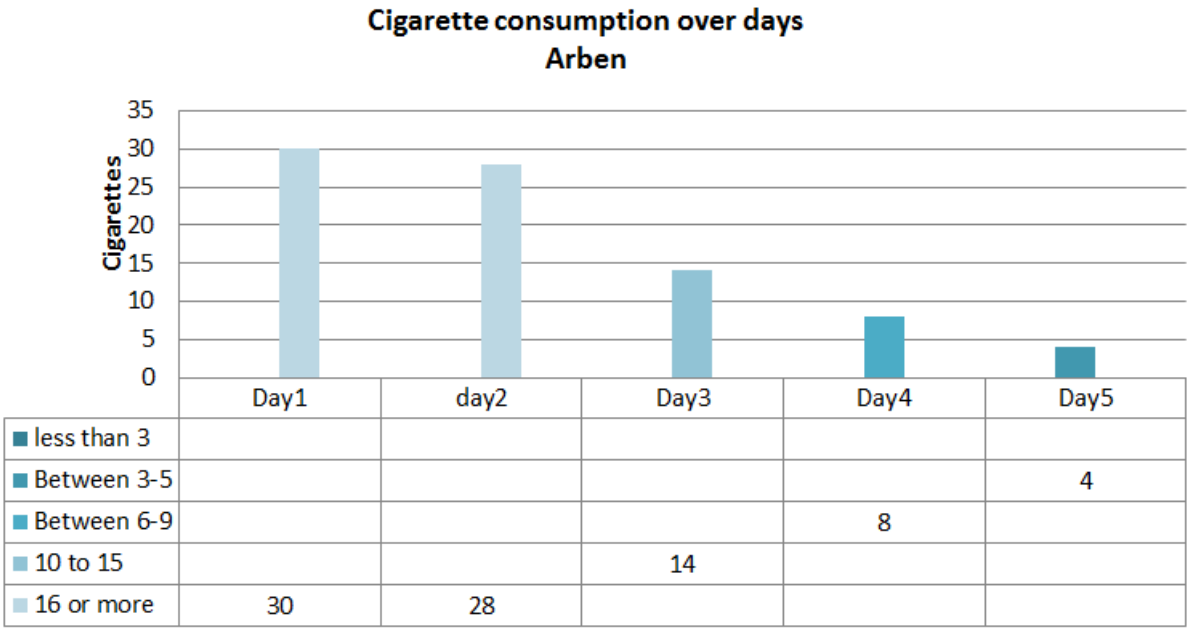


Figure 28, Cigarette consumption over days Arben

This chart represent best graphical result of first user that how in five days he achieves to reduce number of smoked cigarette in a given day, as it is represented here with light sky blue color at day1 column, user has smoked in total 30 cigarettes, followed by day 2 around 28 to day three 14 cigarettes and final day less than five cigarettes, we might say that this is a progress on habit changing. In this case we conclude that research was successful and we achieved desired results.

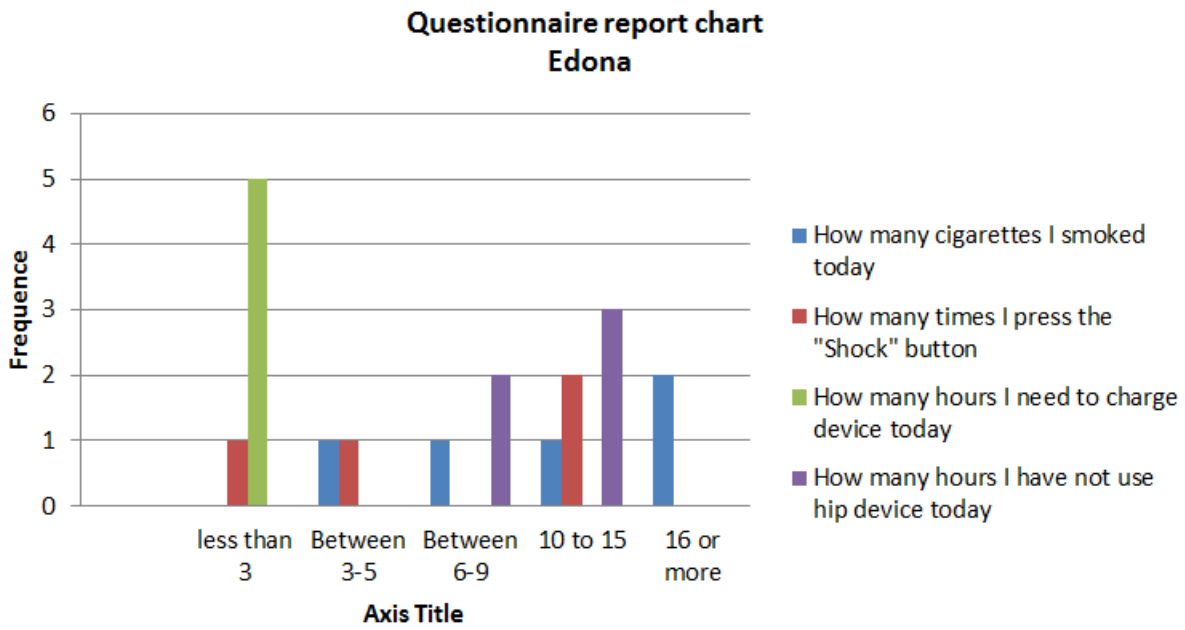


Figure 29, Questionnaire report chart Edona

Other candidate is Edona Memini as user2 in this chart, it also derives from questionnaire above referred to second user, which as we can see there are all answers counted by frequency used, the most frequent answer that user have selected was charging the device, into all five days. User2 has charged device less than three hours, another activity that we see here is that in three days device was not used for 10 to 15 hours a day, also first two days user2 has smoked more than 16 cigarettes, also shock button was used more than 2 days in a range between 10 to 15 times, then frequency of teaser fall into 3 -5 times and finally less than 3 times.

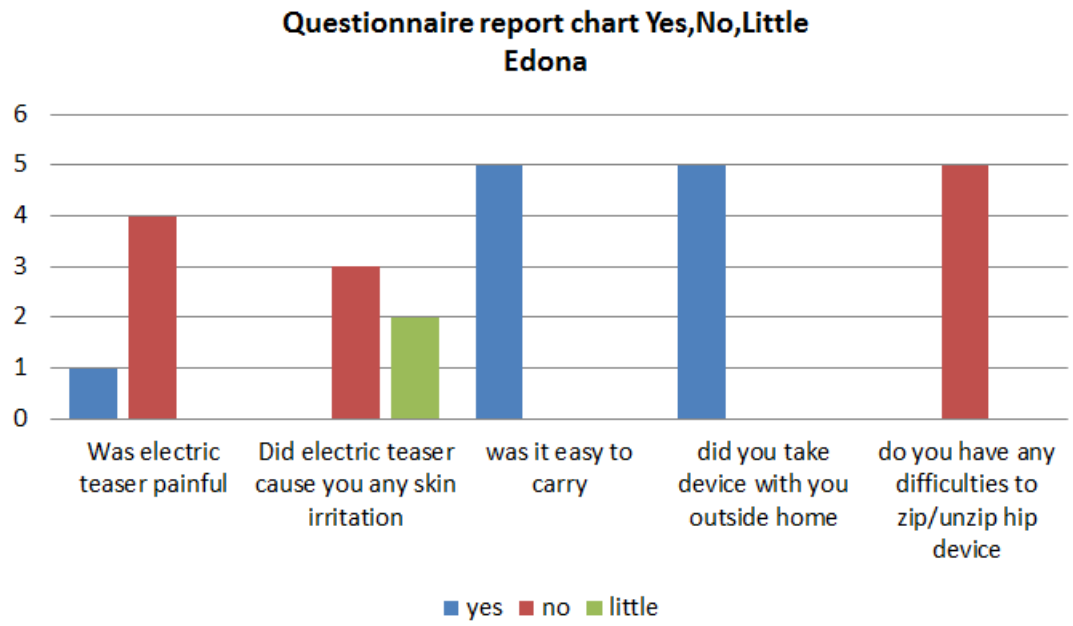


Figure 30, Questionnaire report chart yes/no Edona

This chart represents the second part of questionnaire which was to answer three main questions that was, Yes, No, Little, in five days in row user2 had not difficulties to carry device with itself zip and unzip device, in one day user2 finds painful electric teaser, and two other days find little skin irritation.

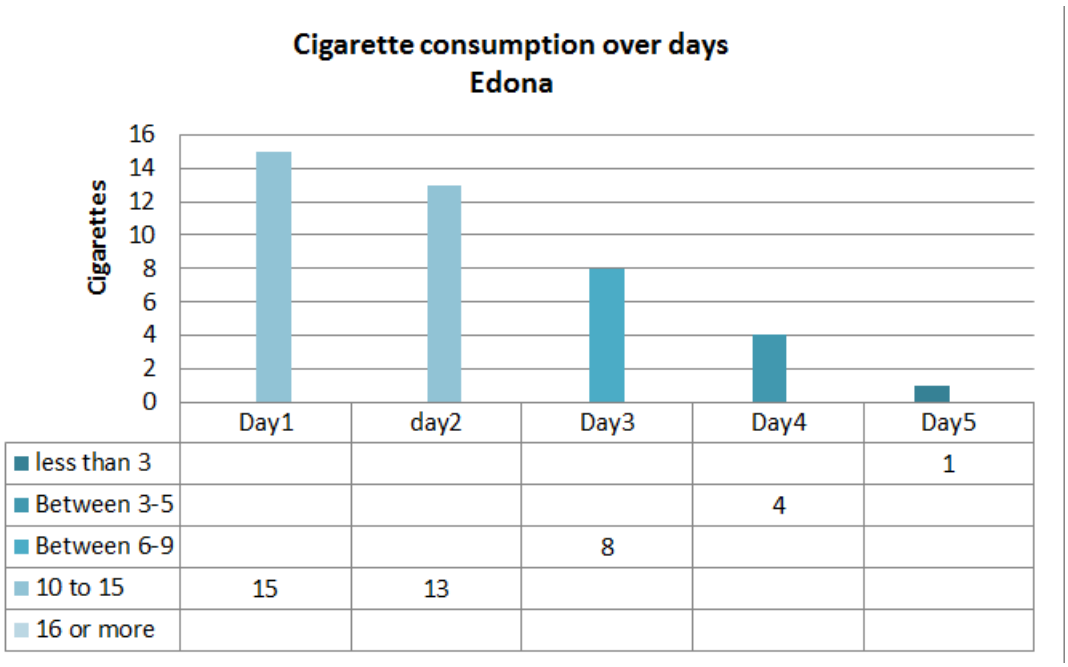


Figure 31, Cigarette consumption over days Edona

This chart represent cigarette consumption over days, in the first day of use hip device user2 consume 15 cigarettes daily, so following by next day that reduce number of cigarettes to 13 after one day use hip device user2 perform a giant drop from 13 to 8 cigarettes by following in day 5 that user consumed only one cigarette at all, from this result we conclude that hip device was very successful in correcting bad habits.

Air pollution measurement in city of Gjilan

One of above criteria is getting device working and testing it into real people to see while it is worth producing or not, next think that we have done is that we have tested our device to accomplish one of given task that was to measure air pollution through device smoking sensor, in this research we have used a mobile phone with android operating system also hip device. Below I have attached a table that describe device that I have used to conduct research all data represented on this chart are based on Gsm Arena webpage [29]

Platform	**Device Name/Version**	Samsung Galaxy Alpha/2014
	OS	Android 5.0.2 (Lollipop)
	Chipset	Exynos 5430 Octa
	CPU	Octa-core (4x1.8 GHz Cortex-A15 & 4x1.3 GHz Cortex-A7)
	GPU	Mali-T628 MP6
Memory	**Internal**	32 GB, 2 GB RAM
Display	**Type**	Super AMOLED capacitive touchscreen, 16M colors
	Resolution	720 x 1280 pixels (~312 ppi pixel density)
COMMS	**WLAN**	Wi-Fi 802.11 a/b/g/n/ac, dual-band, Wi-Fi Direct, hotspot
	Bluetooth	4.0, A2DP, EDR, LE
	GPS	with A-GPS, GLONASS
	USB	MicroUSB 2.0
Battery	**Type**	Removable Li-Ion 1860 mAh battery
	Stand-by	Up to 350 h (3G)

There are some requirements to perform a good research. The case main components that grant success is connection stability between device and mobile phone, the other thing that contribute in best result is weather condition, that day that I have perform measures of air quality weather was mostly cloudy, temperatures was between 16 and 12 °C and humidity 85% air pressure was 1013 mbar, wind was in 2km per hour in north. [19]

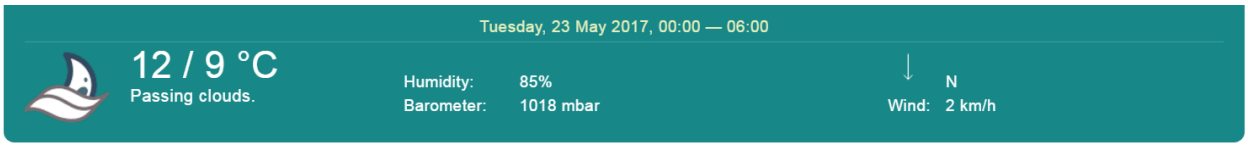


Figure 32, Weather forecast on Tuesday 23 may 20017

With this parameter we considered that there is very favorable condition to perform measurement in open ambient so we did it by walking by the city of Gjilan, in main areas, our journey begin in the road "Haki Efendija" known as "Lagjja e Gavranit" after that we moved near the campus of University of Gjilan "Kadri Zeka" and perform some new measures at the "Zija Shemsiu" road known by local as "Korsa e qytetit" as we walked through this road we also take some other samples from ambient at the road "Abdullah Presheva " to walk further into city center at the road "Esat Berisha" known as "Te rrethi" after that we walked to "Bulevardi I Pavarsise" road which is near with the main city park. Across the road is "Xheme Tupalla" that we take out four samples in two main roads, in this area also another sample in the exit of the city of Gjilan "rr Abdullah Tahiri" and also the last sample was taken by "Marie Shllaku" road. All this samples was taken while I was standing in stood position and each measure took 30 seconds.

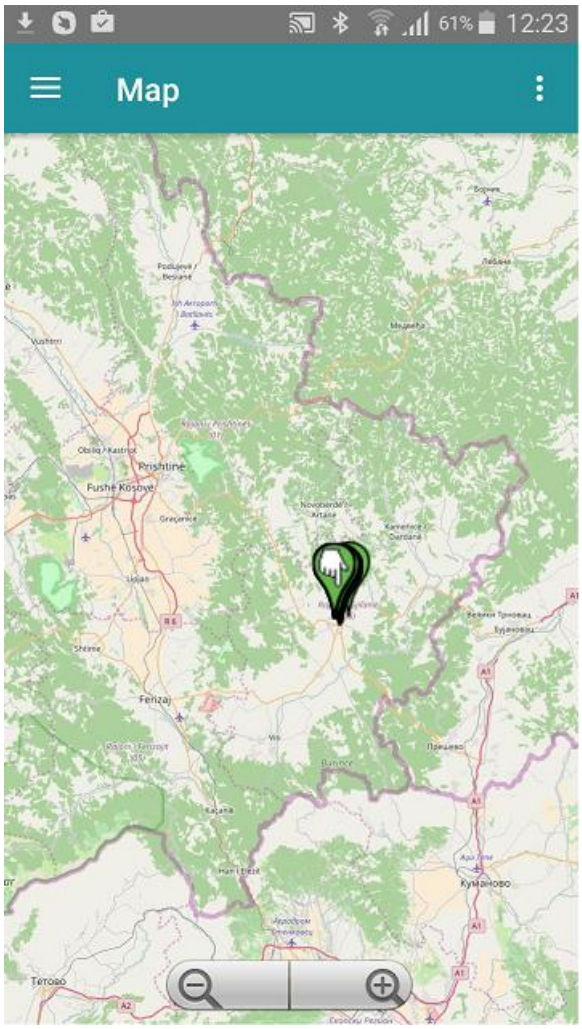


Figure 33, Arial view of city of Gjilan

Figure 34, Markers and measures

There are some screenshot from application that I have performed measures as we zoom in we can see pins getting spread over places that I have taken samples. In the beginning when map is in default position from far we can see that its look like there is only one or two pins but this changes when we zoom in.

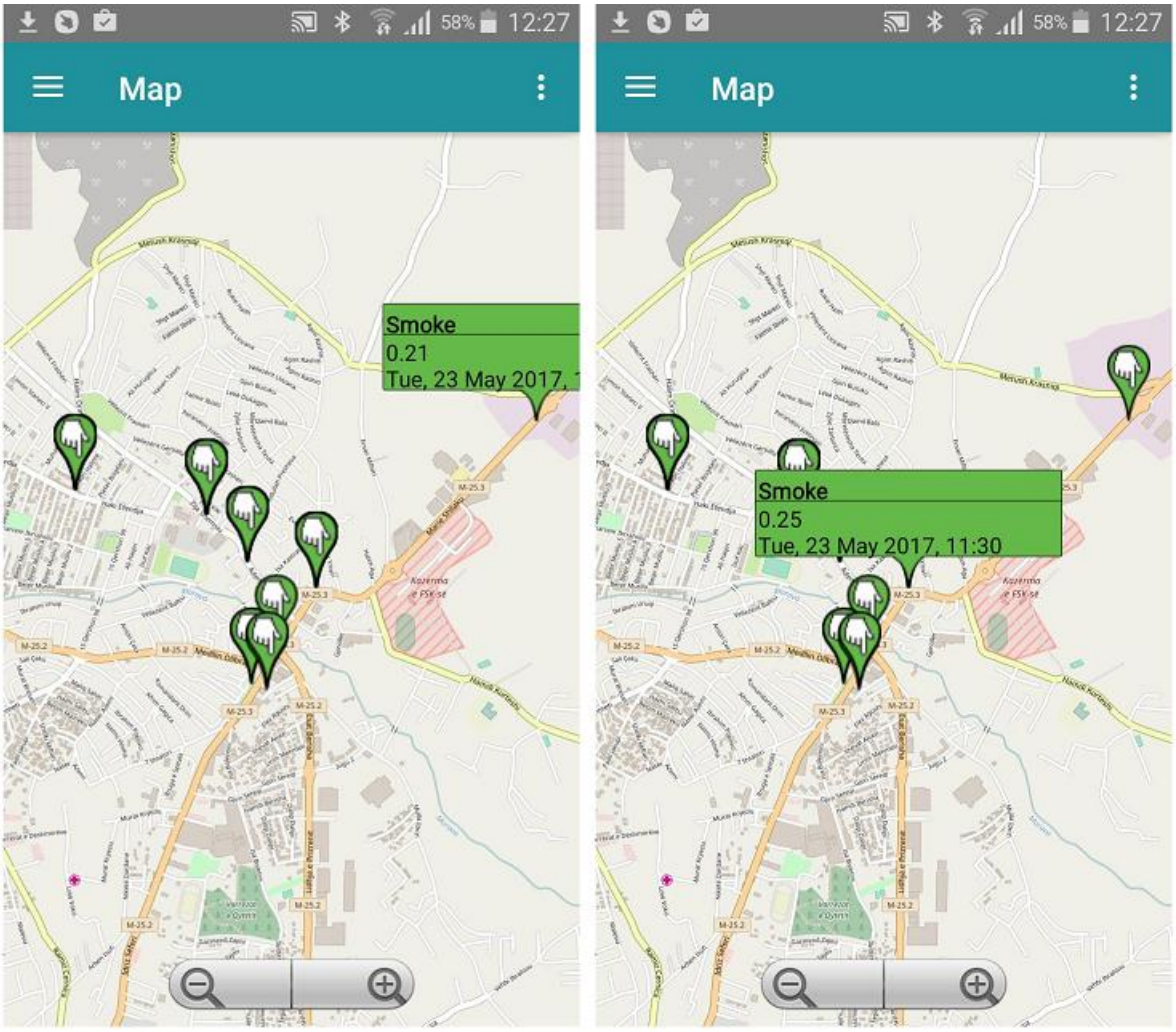


Figure 35 , value of marker 1 and 2

Here we will include all measured data also illustrated with screenshot from the hip application, as we see here there are shown two data in two different places picture on the right represent data that are collected in center of Gjilan, at the "Abdulla Tahiri" road, the value of pollution on that part was 0.25 ppm, following by other measure in periphery of the city at the roundabout road name "Marie Shllaku" that value of pollution was 0.21 ppm that is indicator that there inside in the city pollutants are more spread than outside it.

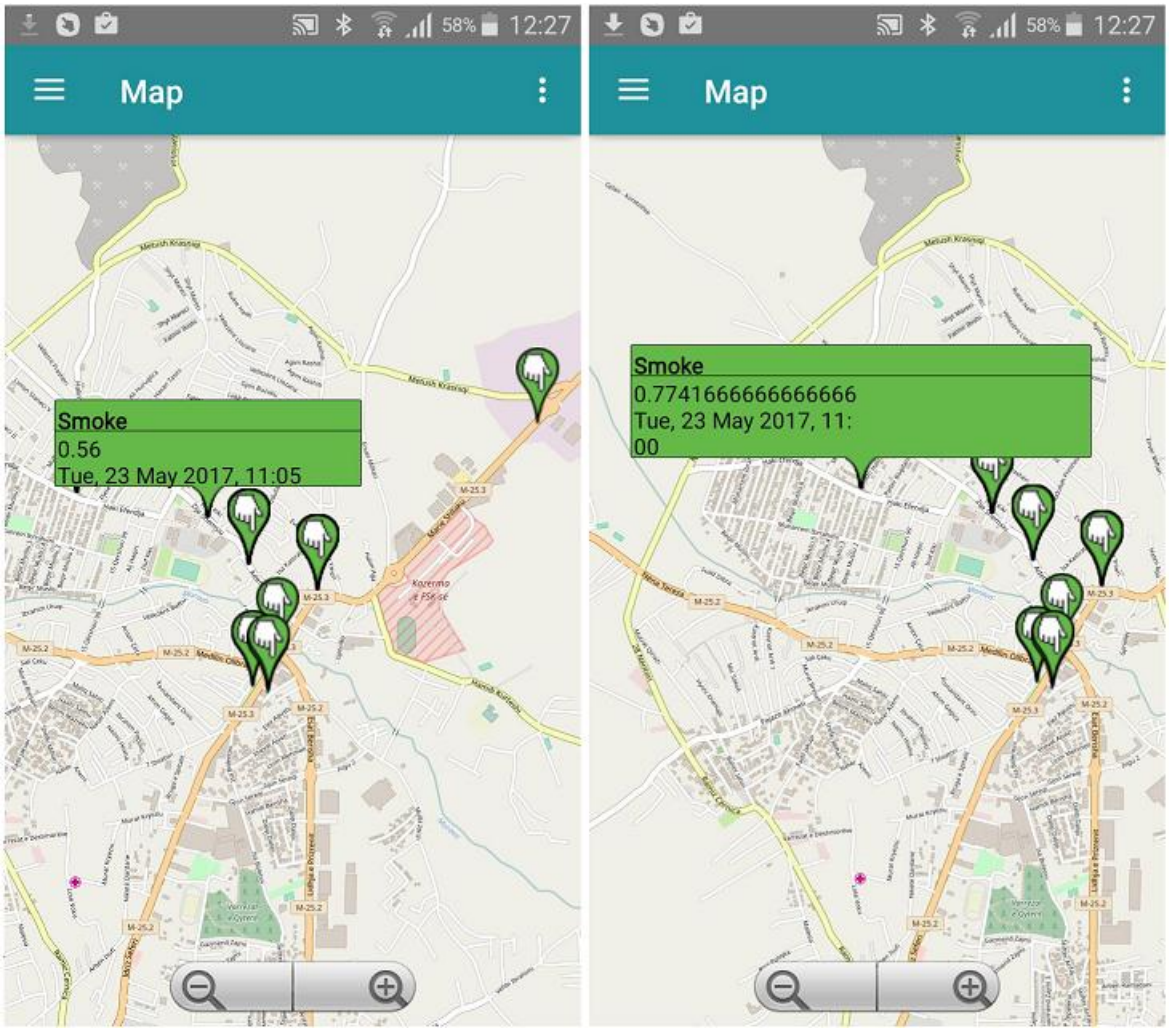


Figure 36, Value of marker 3 and 4

In both pictures are shown locations in which samples for air pollution are collected from hip device, we can see that we have two more location that pups up value in each one. Our journey start in road "Haki Efendija" that is shown in the picture on the right side, we can see that value on this sample is 0.7741666 but we have rounded on 0.77 to avoid unnecessary data and to save space in our application. Compared to other sample, picture on the left we can see all data that are collected are taken by "Zija Shemsiu" road and the value of this data is 0.56 ppm.

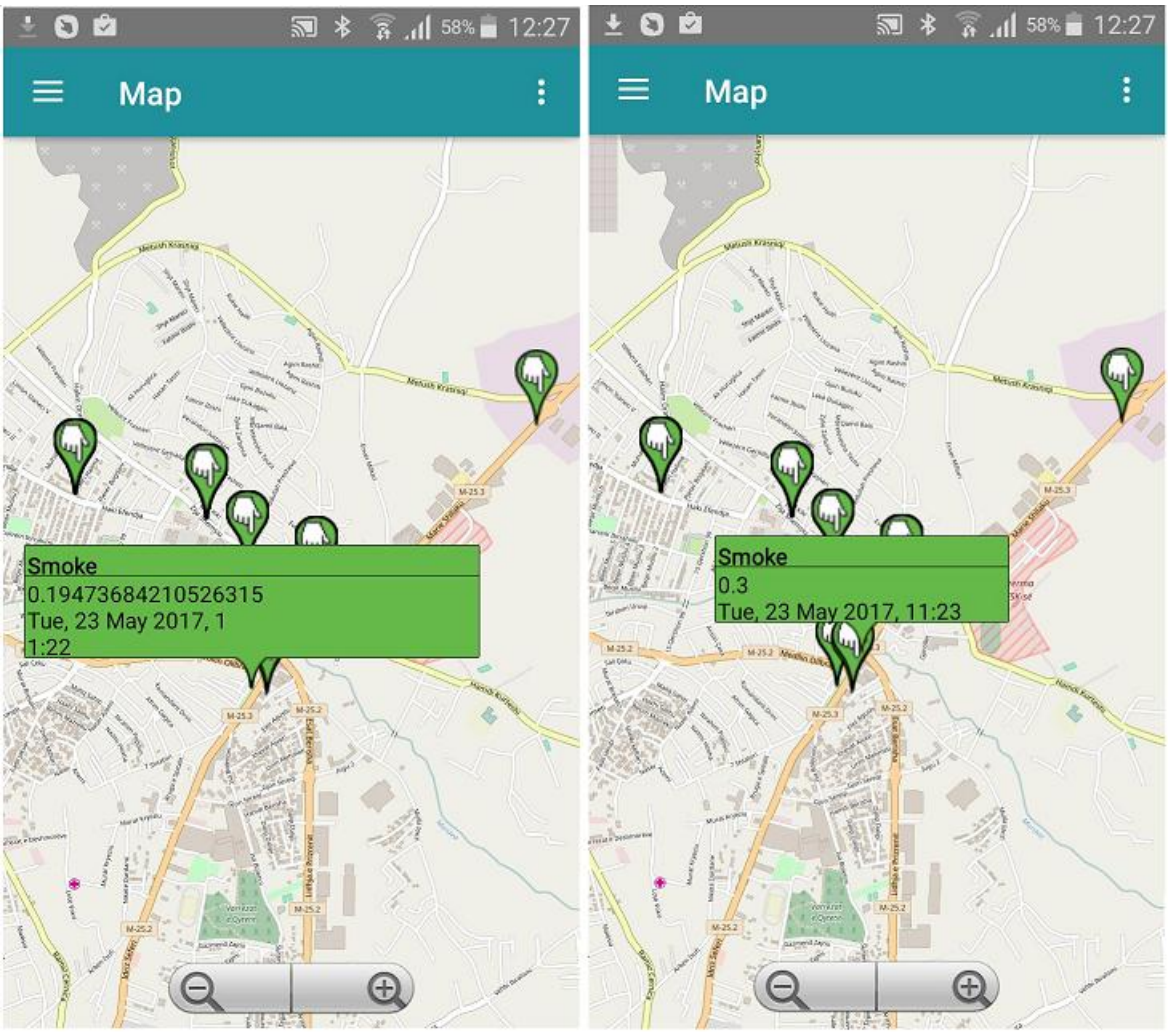
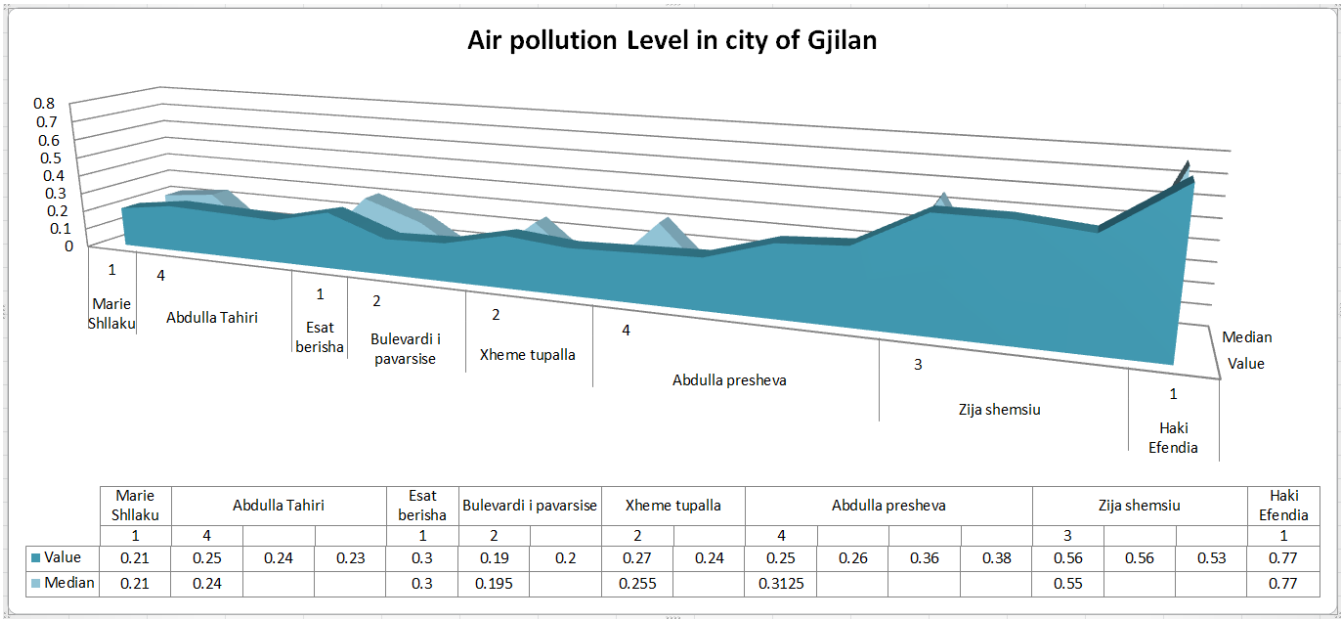


Figure 37 , Value of marker 5 and 6

Main measures was focused into city park that traditionally considered to be cleanest and less polluted place in the city, in this part we have collected two samples in two different roads one is "Esat Berisha" known as city roundabout, which area is very populated by cars and the other two samples was taken inside the city park area at "Bulevardi i Pavarsise" road and other was in opposite direction of park at the road "Xheme Tupalla" in line with the municipal assembly building, inside park we find this value 0.19473 ppm but we rounded in 0.19 ppm to spare us from unnecessary data and the other side we have taken two samples one was 0.24 ppm and some delay change place on that area and take another sample that value was 0.27 ppm.



	Marie Shllaku	Abdulla Tahiri			Esat berisha	Bulevardi i pavarsise		Xheme tupalla		Abdulla presheva				Zija shemsiu			Haki Efendia
	1	4			1	2		2		4				3			1
Value	0.21	0.25	0.24	0.23	0.3	0.19	0.2	0.27	0.24	0.25	0.26	0.36	0.38	0.56	0.56	0.53	0.77
Median	0.21	0.24			0.3	0.195		0.255		0.3125				0.55			0.77

Figure 38, Air pollution level in city of Gjilan

This chart represent graphical data and result that are gathered from hip device, due to show this type of data I have used 3-D Area chart which I have included main variables. In the top of the chart are shown levels of pollution in city of Gjilan that we might consider that day that I had taken measures was a very stable day not so many cars in circulation, all measures are performed between 11:00 Am until 13:00 PM, below chart I have included a list of places that we have been and taken samples, also the number of total measurements is 18, in some places we use only one measure in single coordinates and in others 2 to 4, as we seen in road "Avdulla Presheva" and "Avdulla Tahiri". We have performed four measures in different coordinates in same road, also in "Zija Shemsiu" road we also have collected three samples followed by "Bulevardi I Pavaresise" two samples and "Xheme Tupalla" two samples. We can see that most polluted road-area in this chart is "Haki Efendia" with a median of 0.77 ppm in which you can live, play and so on but air that you breath is more polluted than in other areas.

Figure 39 , detailed pollution map

Considering this measure we conclude that there are different parts of the city that are polluted more than others, in the beginning of the measures we find out that “Lagja e Gavranit” region is more polluted than the other parts of the city by considering that this region is more populated than others going downtown by main road at the “ZijaShemsiu” boulevard we find that pollution rate is falling down from 0.77 ppm in “HakiEfendia” road to 0.56 ppm. We walk through ”Abdulla Presheva” road after we dive into city center we cross street light and we find that air pollution fall to 0.31 ppm, same condition is at the city roundabout road ”EsatBerisha” when pollution is 0.30 ppm a small difference between previous sample, then we walk through city park or “Bulevardi I pavarsise” road in which we take two samples, and we find values 0.195 ppm that we might say that this is less polluted part of Gjilan also we make different measures across the road and the value turn out to be high than in other part of the street 2.55 ppm, again we went from this part of city into a different peripheral area at the roundabout in entrance into city , here also we took a sample of air “Marie Shllaku” 0.21 ppm. So general we can conclude that city of Gjilan is safe to live in. Excluded some areas that are more polluted than others but city also does not exceed the permitted values of air pollution. So it is very safe and healthy to live in this city.

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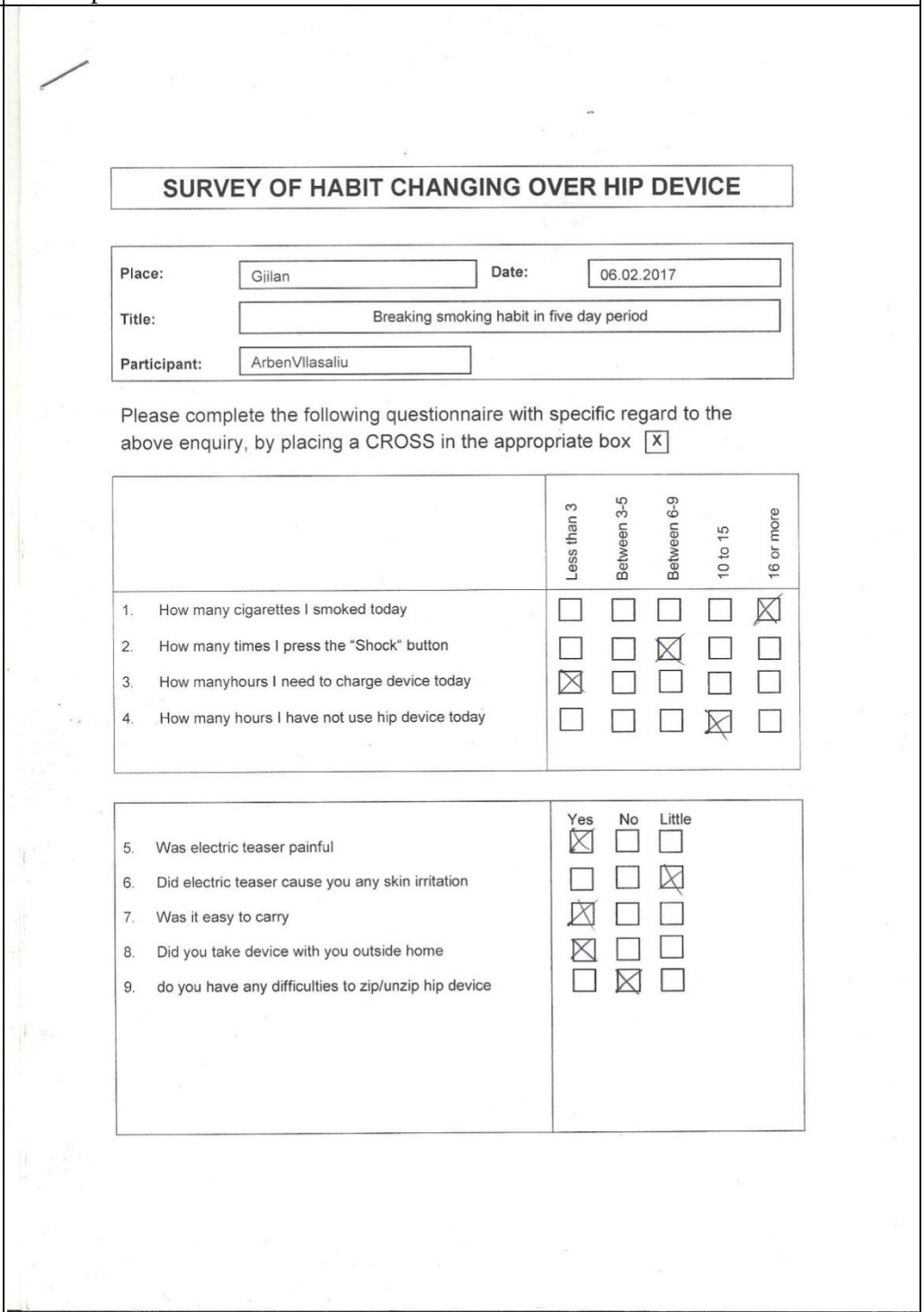
Appendix

Hip can be considered as embedded device which is Operating system free which means that it doesn't have an operating system, fragments of code implemented in microcontroller in hip will give a friendly graphical user interface which includes selecting of program and animation during selection, well defined menu ordered according to importance of application, also fast respond in button selection, some external components are not linked directly with microcontroller. Shocking option comes independently without linked into main chip, just by press of one button it will be activated, with this we mean that we will leave in our conscience while we should press that button or not.

This section is intended to show the questionnaires used in this research by two candidates. Below you can find appendixes for this two subjects:

Questionnaire report and

Hip device code description

Candidate	Description
Arben Vllasaliu	

SURVEY OF HABIT CHANGING OVER HIP DEVICE

Place:	Gjilan	**Date:**	06.02.2017
Title:	Breaking smoking habit in five day period		
Participant:	ArbenVllasaliu		

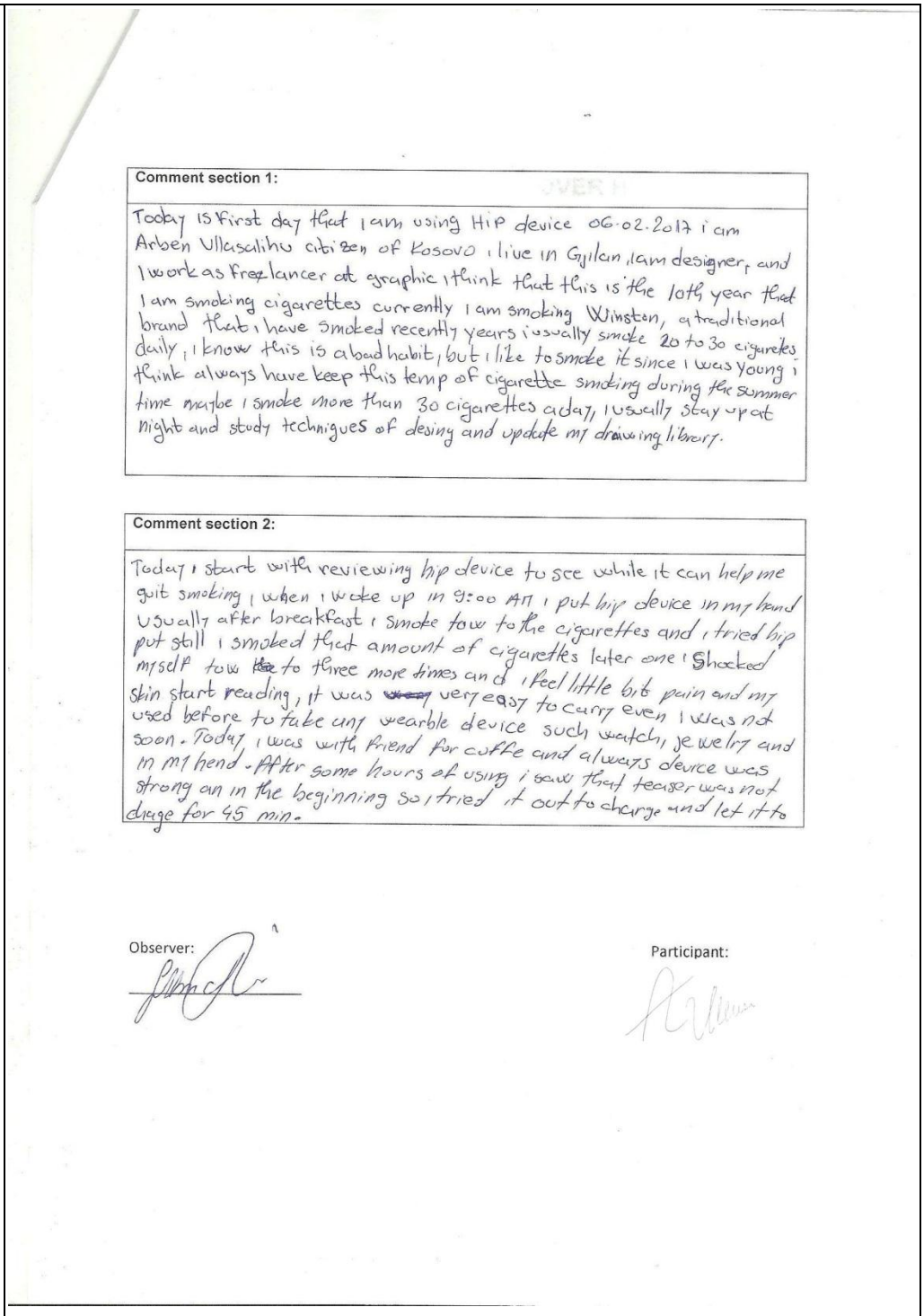
Please complete the following questionnaire with specific regard to the above enquiry, by placing a CROSS in the appropriate box [X]

	Less than 3	Between 3-5	Between 6-9	10 to 15	16 or more
1. How many cigarettes I smoked today	☐	☐	☐	☐	☒
2. How many times I press the "Shock" button	☐	☐	☒	☐	☐
3. How manyhours I need to charge device today	☒	☐	☐	☐	☐
4. How many hours I have not use hip device today	☐	☐	☐	☒	☐

	Yes	No	Little
5. Was electric teaser painful	☒	☐	☐
6. Did electric teaser cause you any skin irritation	☐	☐	☒
7. Was it easy to carry	☒	☐	☐
8. Did you take device with you outside home	☒	☐	☐
9. do you have any difficulties to zip/unzip hip device	☐	☒	☐

Figure 40, Questionnaire day1 user1

Day1



Comment section 1:

Today is first day that I am using Hip device 06.02.2017 I am Arben Ullaslihu citizen of Kosovo I live in Gyilan, I am designer, and I work as freelancer at graphic I think that this is the 10th year that I am smoking cigarettes currently I am smoking Winston, a traditional brand that I have smoked recently years I usually smoke 20 to 30 cigarettes daily, I know this is a bad habit, but I like to smoke it since I was young I think always have keep this temp of cigarette smoking during the summer time maybe I smoke more than 30 cigarettes a day, I usually stay up at night and study techniques of desing and update my drawing library.

Comment section 2:

Today I start with reviewing hip device to see while it can help me quit smoking, when I wake up in 9:00 AM I put hip device in my hand usually after breakfast I smoke tow to the cigarettes and I tried hip put still I smoked that amount of cigarettes later one I shocked myself tow ~~the~~ to three more times and I feel little bit pain and my skin start reading, it was ~~very~~ very easy to carry even I was not used before to take any wearable device such watch, jewelry and soon. Today I was with friend for coffe and always device was in my hend. After some hours of using I saw that teaser was not strong on in the beginning so I tried it out to charge and let it to drage for 45 min.

Observer:

Participant:

Figure 41, Questionnaire day2 extended user1

Day2

SURVEY OF HABIT CHANGING OVER HIP DEVICE

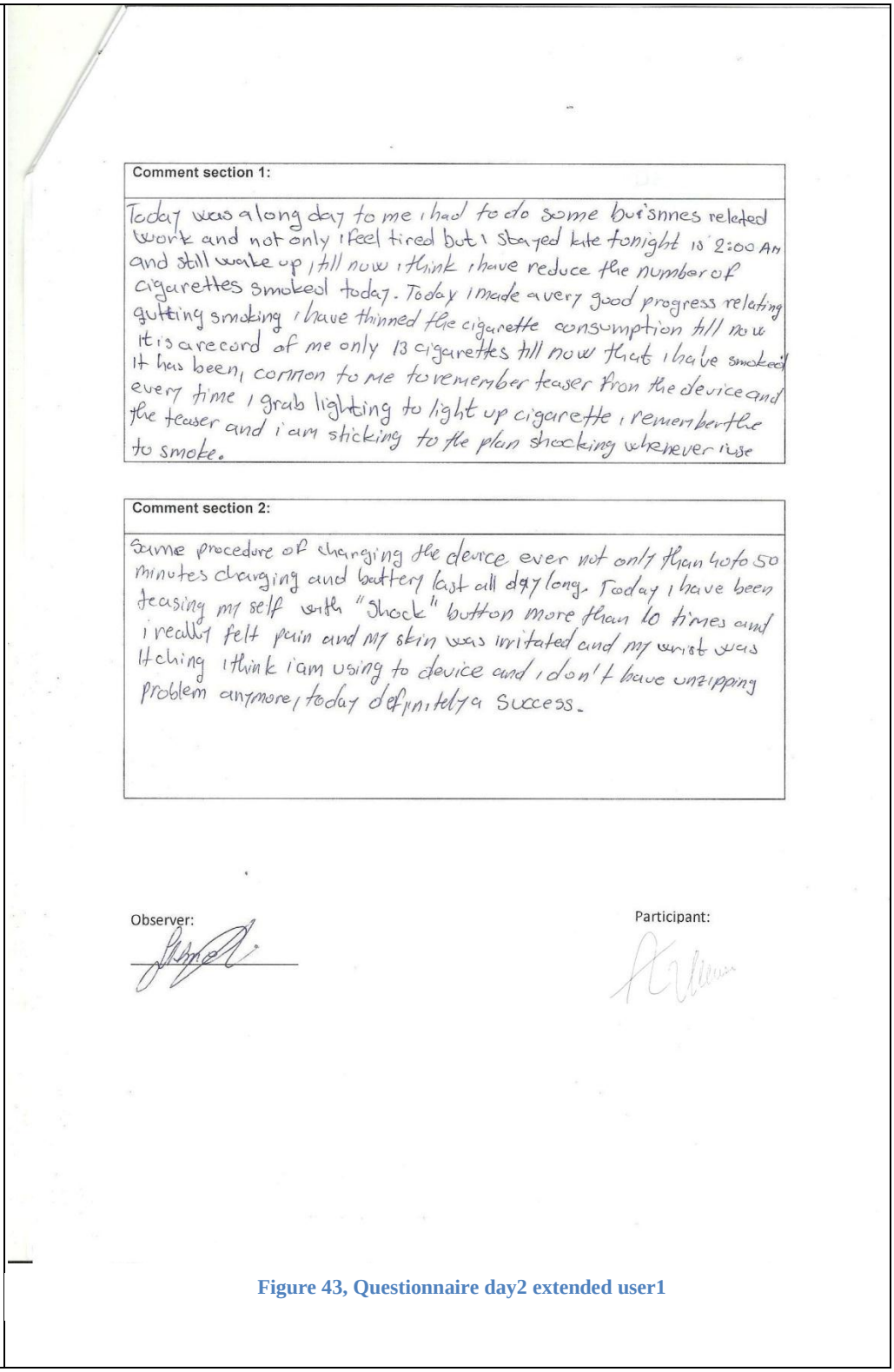
Place:	Giilan	**Date:**	07.02.2017
Title:	Breaking smoking habit in five day period		
Participant:	ArbenVllasaliu		

Please complete the following questionnaire with specific regard to the above enquiry, by placing a CROSS in the appropriate box [X]

	Less than 3	Between 3-5	Between 6-9	10 to 15	16 or more
1. How many cigarettes I smoked today	☐	☐	☐	☐	☒
2. How many times I press the "Shock" button	☐	☐	☐	☒	☐
3. How manyhours I need to charge device today	☒	☐	☐	☐	☐
4. How many hours I have not use hip device today	☐	☐	☐	☒	☐

	Yes	No	Little
5. Was electric teaser painful	☐	☒	☐
6. Did electric teaser cause you any skin irritation	☐	☒	☐
7. Was it easy to carry	☒	☐	☐
8. Did you take device with you outside home	☒	☐	☐
9. do you have any difficulties to zip/unzip hip device	☐	☐	☒

Figure 42, Questionnaire day2 user1



Comment section 1:

Today was a long day to me i had to do some business related work and not only i feel tired but i stayed late tonight is 2:00 AM and still wake up, till now i think i have reduce the number of cigarettes smoked today. Today i made a very good progress relating gutting smoking i have thinned the cigarette consumption till now it is a record of me only 13 cigarettes till now that i have smoked it has been, common to me to remember teaser from the device and every time i grab lighting to light up cigarette, remember the the teaser and i am sticking to the plan shocking wherever i use to smoke.

Comment section 2:

Same procedure of charging the device ever not only than 40 to 50 minutes charging and battery last all day long. Today i have been teasing my self with "Shock" button more than 10 times and i really felt pain and my skin was irritated and my wrist was itching i think i am using to device and i don't have unzipping problem anymore, today definitely a success.

Observer:

Participant:

Figure 43, Questionnaire day2 extended user1

Day3

SURVEY OF HABIT CHANGING OVER HIP DEVICE

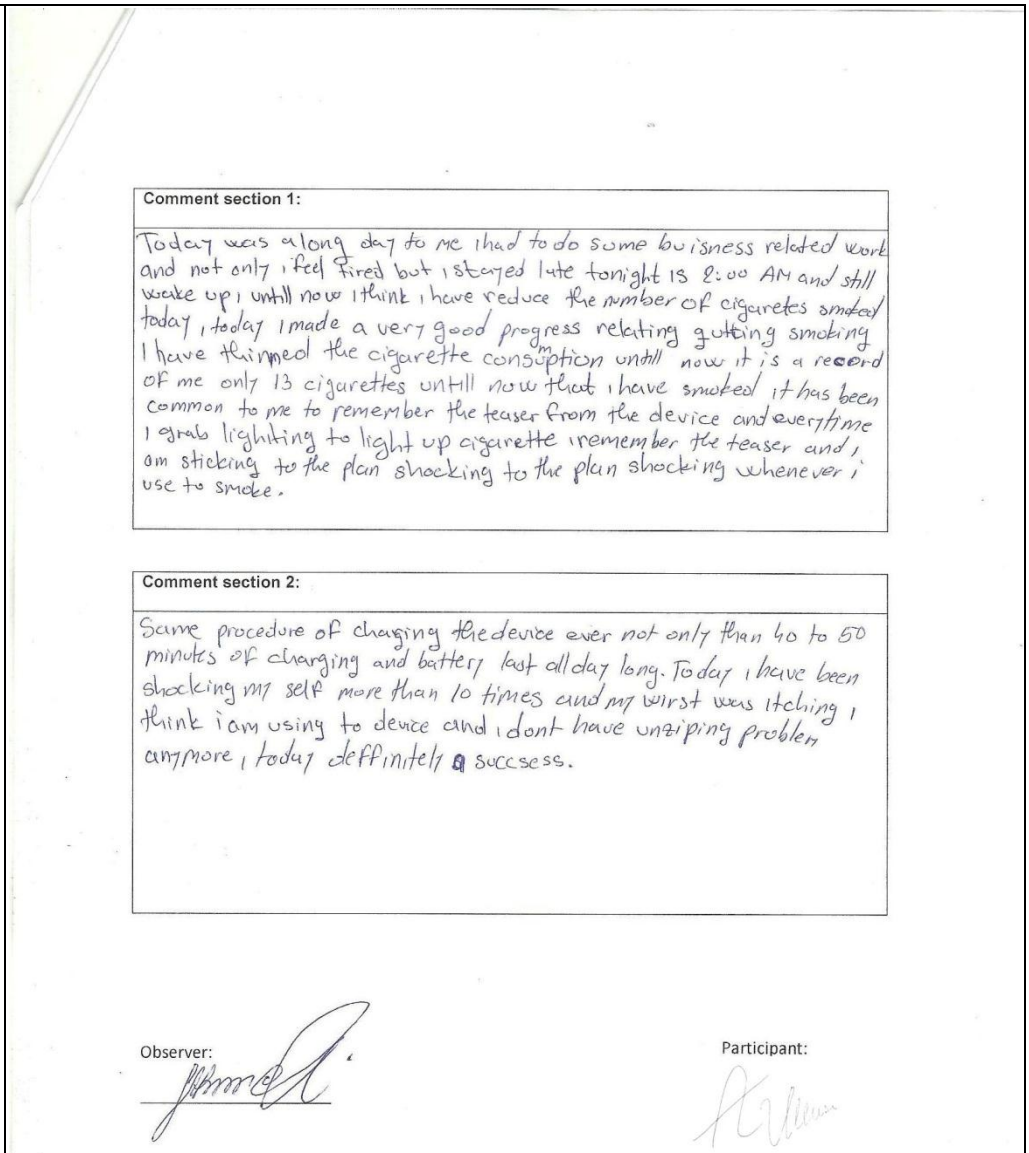
Place:	Gjilan	**Date:**	08.02.2017
Title:	Breaking smoking habit in five day period		
Participant:	ArbenVllasaliu		

Please complete the following questionnaire with specific regard to the above enquiry, by placing a CROSS in the appropriate box [X]

	Less than 3	Between 3-5	Between 6-9	10 to 15	16 or more
1. How many cigarettes I smoked today	☐	☐	☐	☒	☐
2. How many times I press the "Shock" button	☐	☐	☐	☒	☐
3. How manyhours I need to charge device today	☒	☐	☐	☐	☐
4. How many hours I have not use hip device today	☐	☐	☒	☐	☐

	Yes	No	Little
5. Was electric teaser painful	☒	☐	☐
6. Did electric teaser cause you any skin irritation	☒	☐	☐
7. Was it easy to carry	☒	☐	☐
8. Did you take device with you outside home	☒	☐	☐
9. do you have any difficulties to zip/unzip hip device	☐	☒	☐

Figure 44, Questionnaire day3 user1



Comment section 1:

Today was a long day to me I had to do some business related work and not only I feel tired but I stayed late tonight is 8:00 AM and still wake up, until now I think I have reduce the number of cigaretes smoked today, today I made a very good progress relating guting smoking I have thinned the cigarette consuption until now it is a record of me only 13 cigarettes until now that I have smoked it has been common to me to remember the teaser from the device and everytime I grab lighiting to light up cigarette I remember the teaser and I am sticking to the plan shocking to the plan shocking whenever I use to smoke.

Comment section 2:

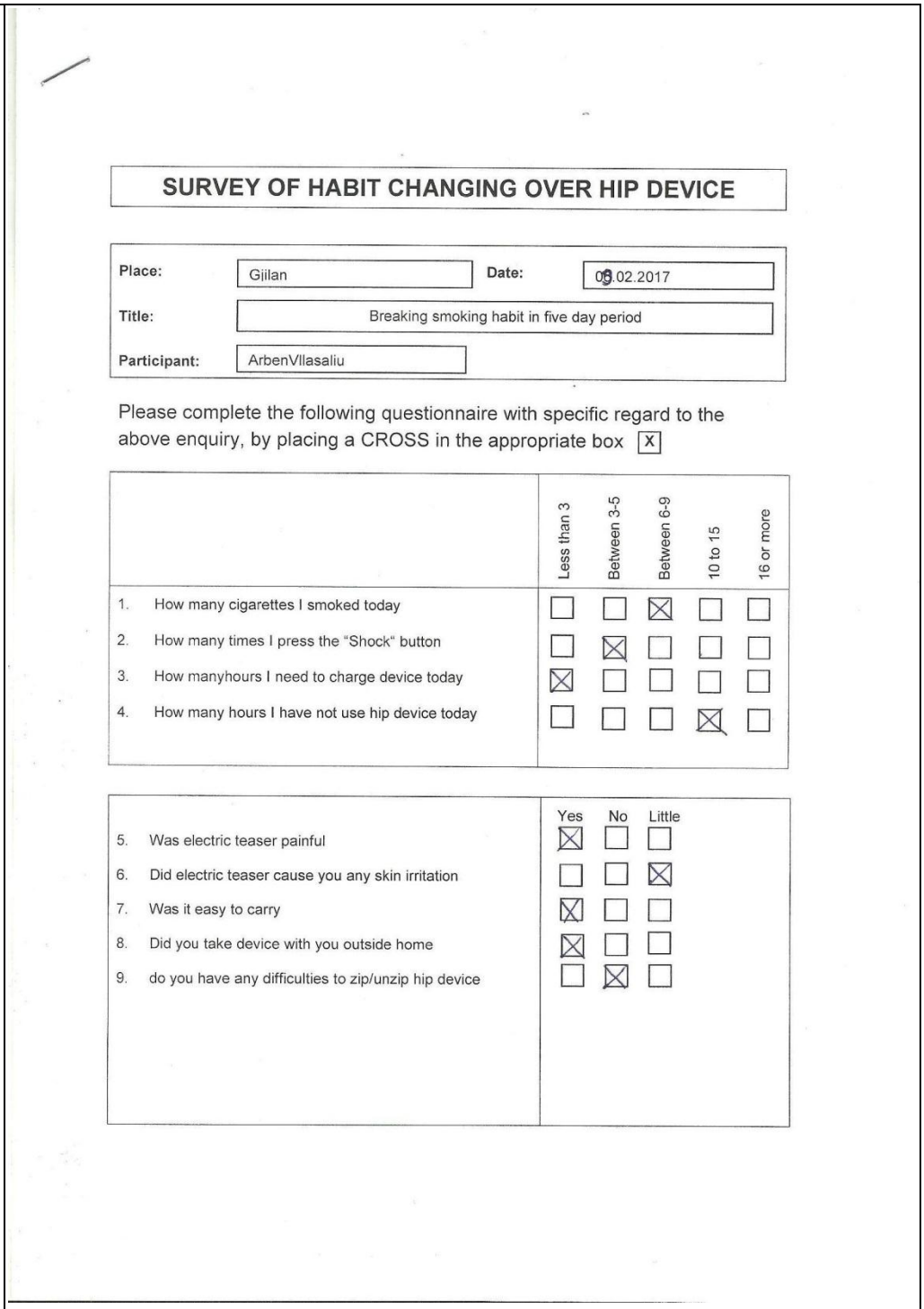
Same procedure of charging the device ever not only than 40 to 50 minutes of charging and battery last all day long. Today I have been shocking my self more than 10 times and my wirst was itching I think I am using to device and I dont have unziping problem anymore, today deffinitely a succsess.

Observer:

Participant:

Figure 45, Questionnaire day3 extended user1

Day4



SURVEY OF HABIT CHANGING OVER HIP DEVICE

Place:	Gjilan	**Date:**	09.02.2017
Title:	Breaking smoking habit in five day period		
Participant:	ArbenVllasaliu		

Please complete the following questionnaire with specific regard to the above enquiry, by placing a CROSS in the appropriate box [X]

	Less than 3	Between 3-5	Between 6-9	10 to 15	16 or more
1. How many cigarettes I smoked today	☐	☐	☒	☐	☐
2. How many times I press the "Shock" button	☐	☒	☐	☐	☐
3. How manyhours I need to charge device today	☒	☐	☐	☐	☐
4. How many hours I have not use hip device today	☐	☐	☐	☒	☐

	Yes	No	Little
5. Was electric teaser painful	☒	☐	☐
6. Did electric teaser cause you any skin irritation	☐	☐	☒
7. Was it easy to carry	☒	☐	☐
8. Did you take device with you outside home	☒	☐	☐
9. do you have any difficulties to zip/unzip hip device	☐	☒	☐

Figure 46, Questionnaire day4 user1

Comment section 1:

It is Thursday 9nth of February 2017 i am fucused on some different homeworks and i was forgeting at all to smoke cigaretes. Evrytimes i think of cigarettes i think also hip so it has been a realitionship between hip and cigarettes instead of remembering the joy that cigarettes give to me i remember the brute force that hip uses to warn me about health concern of cigarettes itself no more herrasment of my self no more smoking i always repeat to my self. ~~today~~

Comment section 2:

Today was the day, that i smoked only 7 cigarettes so a pack of cigarettes that i use to spend in half day now i am saving for 3 day this is quite progress from 30 cigarettes into 7 cigarettes thats good, also ~~&~~ today i felt little itch but in generally I am satisfied.

Observer:

Participant:

Figure 47, Questionnaire day4 extended user1

Day5

SURVEY OF HABIT CHANGING OVER HIP DEVICE

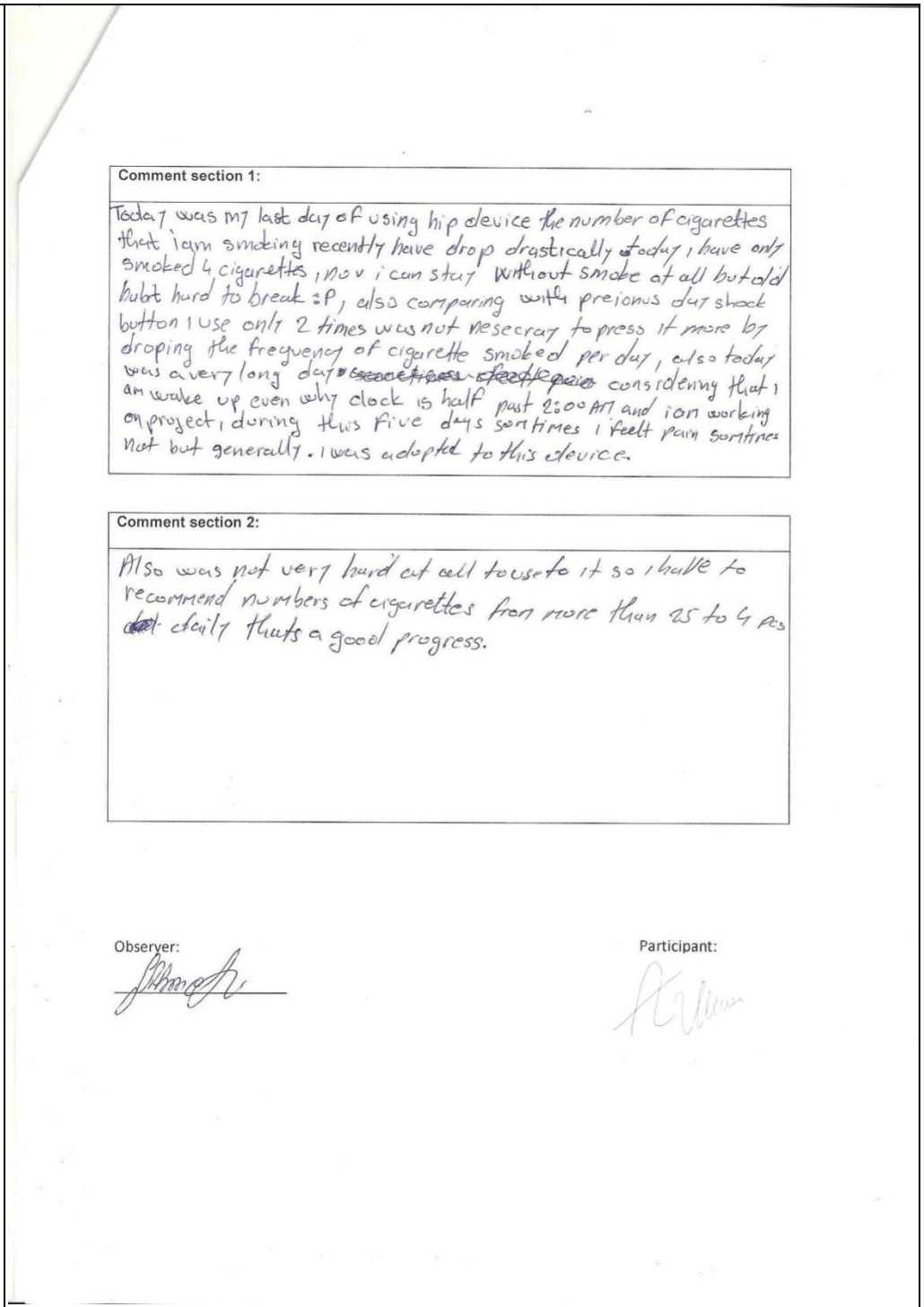
Place:	Gjilan	**Date:**	08.02.2017
Title:	Breaking smoking habit in five day period		
Participant:	ArbenVllasaliu		

Please complete the following questionnaire with specific regard to the above enquiry, by placing a CROSS in the appropriate box [X]

	Less than 3	Between 3-5	Between 6-9	10 to 15	16 or more
1. How many cigarettes I smoked today	☐	☒	☐	☐	☐
2. How many times I press the "Shock" button	☒	☐	☐	☐	☐
3. How manyhours I need to charge device today	☒	☐	☐	☐	☐
4. How many hours I have not use hip device today	☐	☐	☒	☐	☐

	Yes	No	Little
5. Was electric teaser painful	☐	☒	☐
6. Did electric teaser cause you any skin irritation	☐	☒	☐
7. Was it easy to carry	☒	☐	☐
8. Did you take device with you outside home	☒	☐	☐
9. do you have any difficulties to zip/unzip hip device	☐	☒	☐

Figure 48, Questionnaire day5 user1



Comment section 1:

Today was my last day of using hip device the number of cigarettes that i am smoking recently have drop drastically today, i have only smoked 4 cigarettes, now i can stay without smoke at all but old habit hard to break :P, also comparing with preionus day shock button i use only 2 times was not nesecray to press it more by droping the freqyency of cigarette smoked per day, also today was a very long day ~~[illegible]~~ considering that i am wake up even why clock is half past 2:00 AM and i am working on project, during this five days sometimes i feelt pain somtimes not but generally. i was adopted to this device.

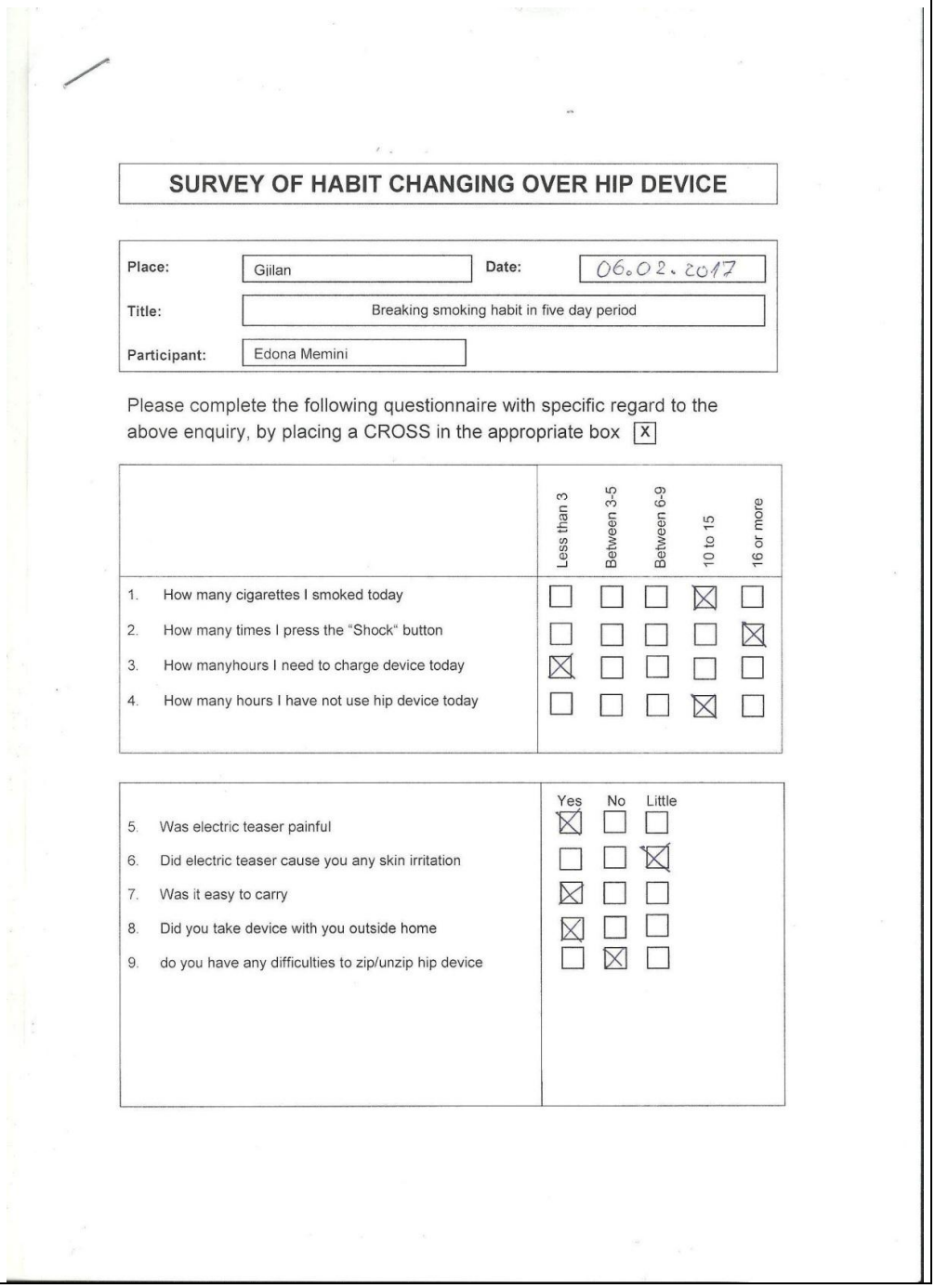
Comment section 2:

Also was not very hard at all to use to it so i halve to recommend numbers of cigarettes from more than 25 to 4 ~~[illegible]~~ daily thats a good progress.

Observer:

Participant:

Figure 49, Questionnaire day5 extended user1

Candidate	Description
Edona Memini	

SURVEY OF HABIT CHANGING OVER HIP DEVICE

Place:	Gjilan	**Date:**	06.02.2017
Title:	Breaking smoking habit in five day period		
Participant:	Edona Memini		

Please complete the following questionnaire with specific regard to the above enquiry, by placing a CROSS in the appropriate box [X]

	Less than 3	Between 3-5	Between 6-9	10 to 15	16 or more
1. How many cigarettes I smoked today	☐	☐	☐	☒	☐
2. How many times I press the "Shock" button	☐	☐	☐	☐	☒
3. How manyhours I need to charge device today	☒	☐	☐	☐	☐
4. How many hours I have not use hip device today	☐	☐	☐	☒	☐

	Yes	No	Little
5. Was electric teaser painful	☒	☐	☐
6. Did electric teaser cause you any skin irritation	☐	☐	☒
7. Was it easy to carry	☒	☐	☐
8. Did you take device with you outside home	☒	☐	☐
9. do you have any difficulties to zip/unzip hip device	☐	☒	☐

Day1

Comment section 1:

Today is first day that i am using this device 06.02.2019 i am [redacted] Edona Memini citizen of Kosovo i live in Gjilan i am journalist i work for Zëri tv. I also lead two shows "Çelesi muzikor" and "Zhurma Show". this job require lot of hard work and dedication, while i am sucessful in my profession i also have a bad habit which is that i am a smoker. i consume 10 TO 20 cigaretes per day, which is not healthy at all, but with this technology that my friend Granit have introduced to me i will review while it can help me to quit smoking

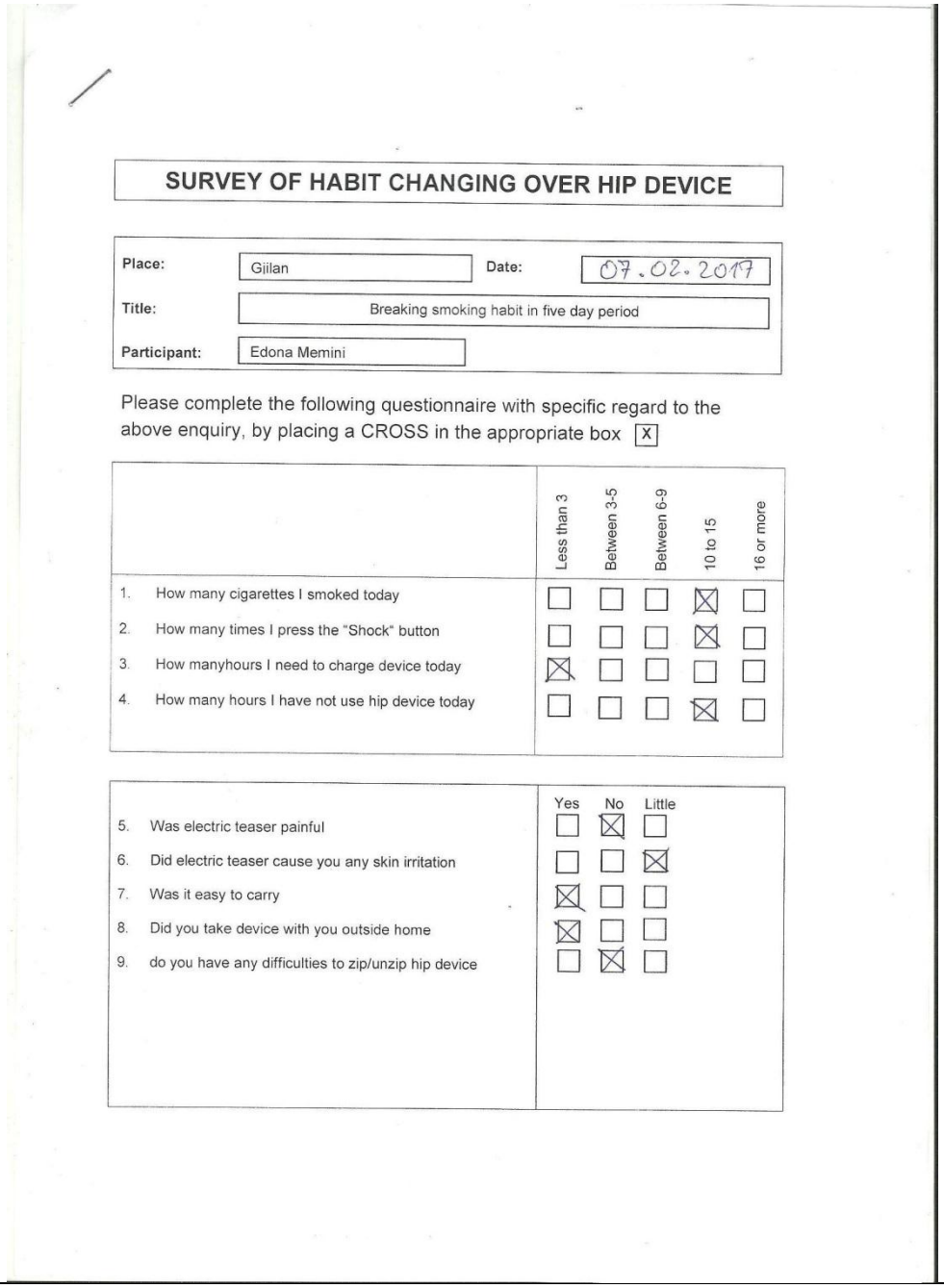
Comment section 2:

Today i start with reviewing this device to see while it can help me quit smoking, my routine today include lots of coffe, lots of fast food and also cigarettes, well today i was using this device all day long as the first time as i have used such device i find weird to get shocked by myself, everytime that i smoke, cigarettes. Shocked by myself, everytime that i smoke a cigarette. and i have been today i smoke in total 15 cigarette. and i have been shocking myself more than 10 times which i felt little pain and skin irritation but after all it was easy to we and fast to operate.

Observer:

Participant:

Day2



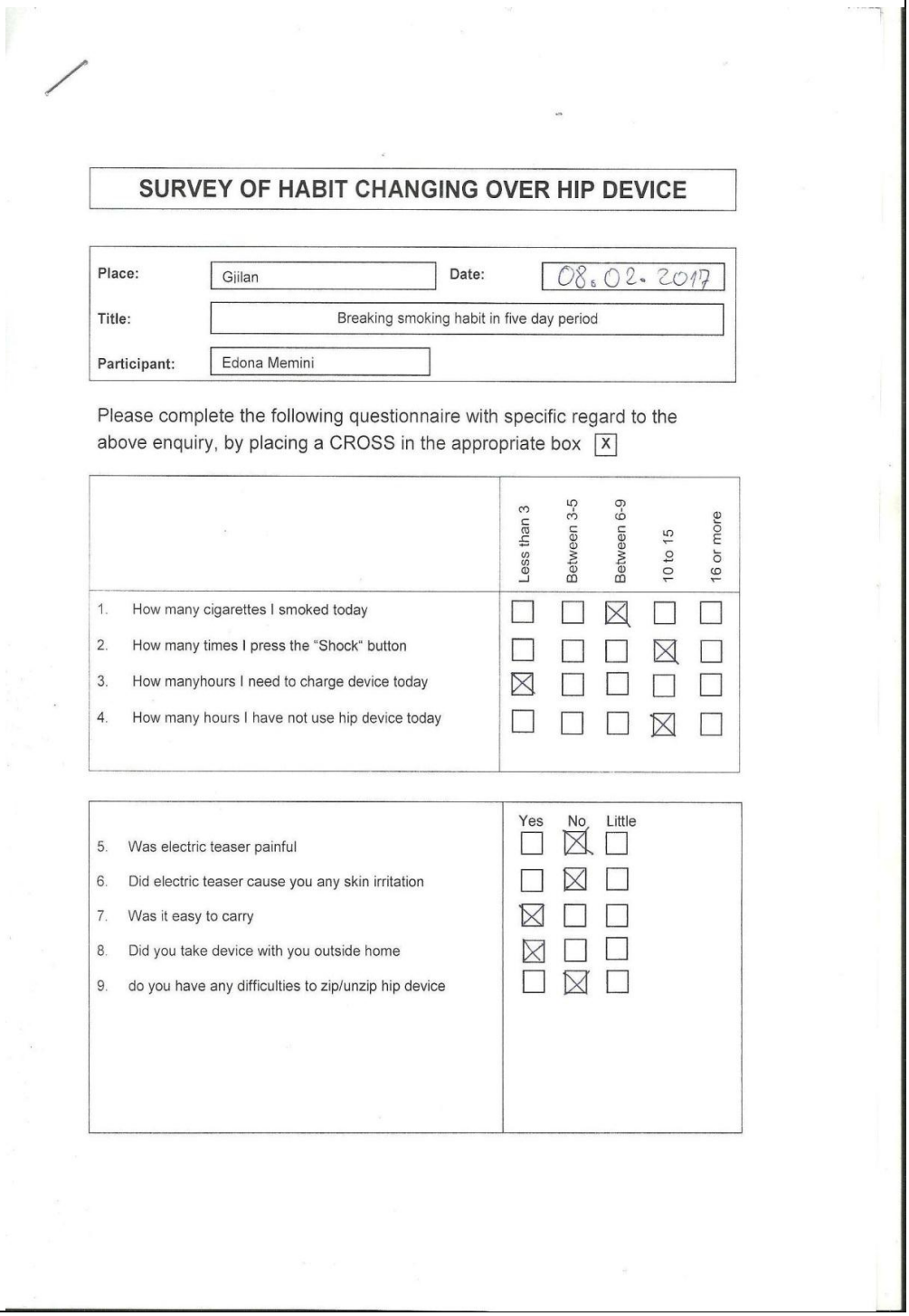
SURVEY OF HABIT CHANGING OVER HIP DEVICE

Place:	Gilan	**Date:**	07.02.2017
Title:	Breaking smoking habit in five day period		
Participant:	Edona Memini		

Please complete the following questionnaire with specific regard to the above enquiry, by placing a CROSS in the appropriate box [X]

	Less than 3	Between 3-5	Between 6-9	10 to 15	16 or more
1. How many cigarettes I smoked today	☐	☐	☐	☒	☐
2. How many times I press the "Shock" button	☐	☐	☐	☒	☐
3. How manyhours I need to charge device today	☒	☐	☐	☐	☐
4. How many hours I have not use hip device today	☐	☐	☐	☒	☐

	Yes	No	Little
5. Was electric teaser painful	☐	☒	☐
6. Did electric teaser cause you any skin irritation	☐	☐	☒
7. Was it easy to carry	☒	☐	☐
8. Did you take device with you outside home	☒	☐	☐
9. do you have any difficulties to zip/unzip hip device	☐	☒	☐

Day3	

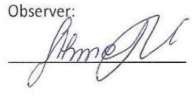
SURVEY OF HABIT CHANGING OVER HIP DEVICE

Place:	Giilan	**Date:**	08.02.2017
Title:	Breaking smoking habit in five day period		
Participant:	Edona Memini		

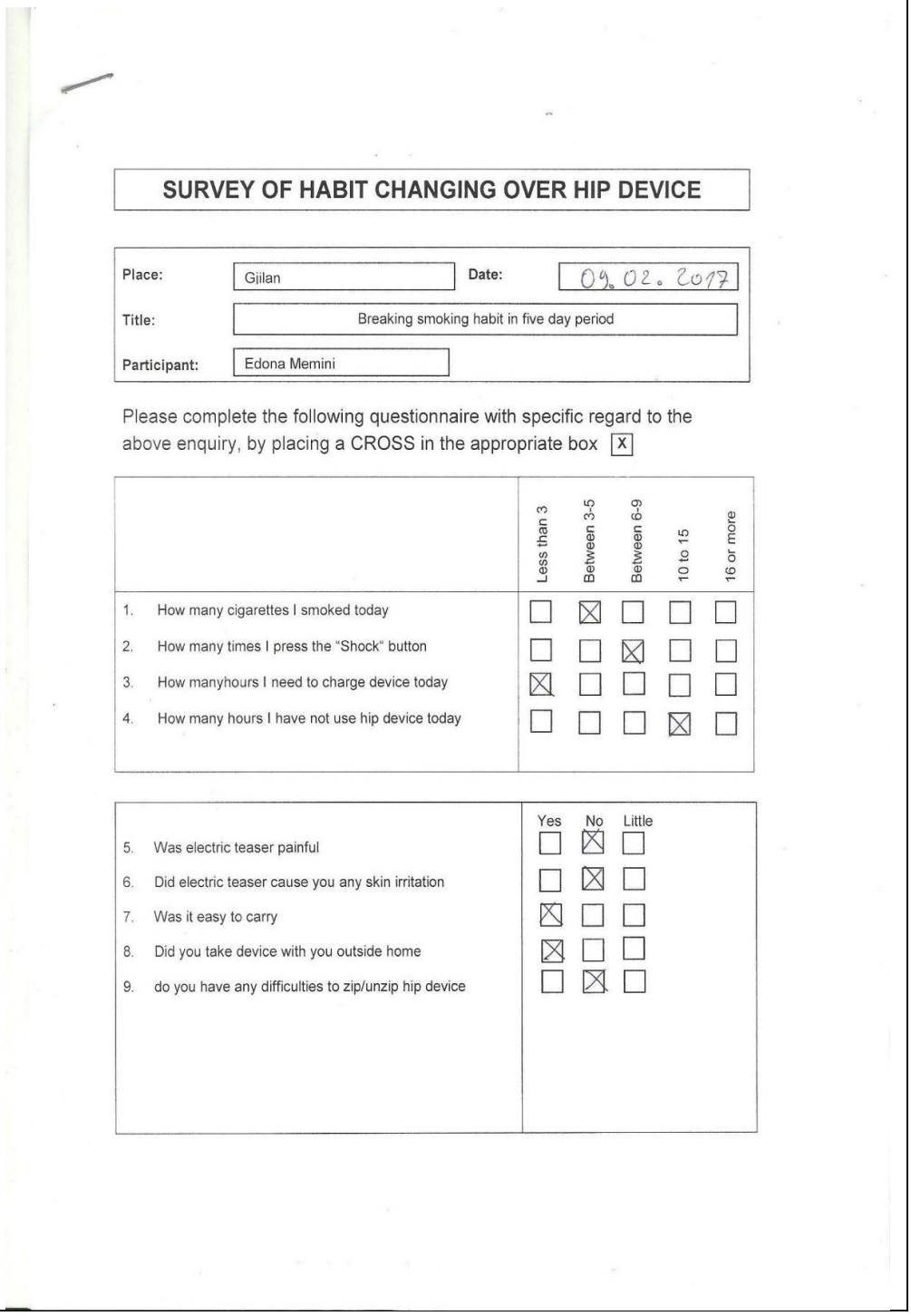
Please complete the following questionnaire with specific regard to the above enquiry, by placing a CROSS in the appropriate box [X]

	Less than 3	Between 3-5	Between 6-9	10 to 15	16 or more
1. How many cigarettes I smoked today	☐	☐	☒	☐	☐
2. How many times I press the "Shock" button	☐	☐	☐	☒	☐
3. How manyhours I need to charge device today	☒	☐	☐	☐	☐
4. How many hours I have not use hip device today	☐	☐	☐	☒	☐

	Yes	No	Little
5. Was electric teaser painful	☐	☒	☐
6. Did electric teaser cause you any skin irritation	☐	☒	☐
7. Was it easy to carry	☒	☐	☐
8. Did you take device with you outside home	☒	☐	☐
9. do you have any difficulties to zip/unzip hip device	☐	☒	☐

	Comment section 1: As isee today i have reduced the number of cigarettes From yesterday, in total i have smoked only 7 cigarettes and i am Gettin Use to this device. today i shocked myself more that was necesary i just tried tezer couple more time just as my personal experiment, i didn't feel pain in my wrist anymore. i also don't have problem anymore to zip and unzip device so in General i am sattisfied with it. **Comment section 2:** Observer:  Participant: 

Day4



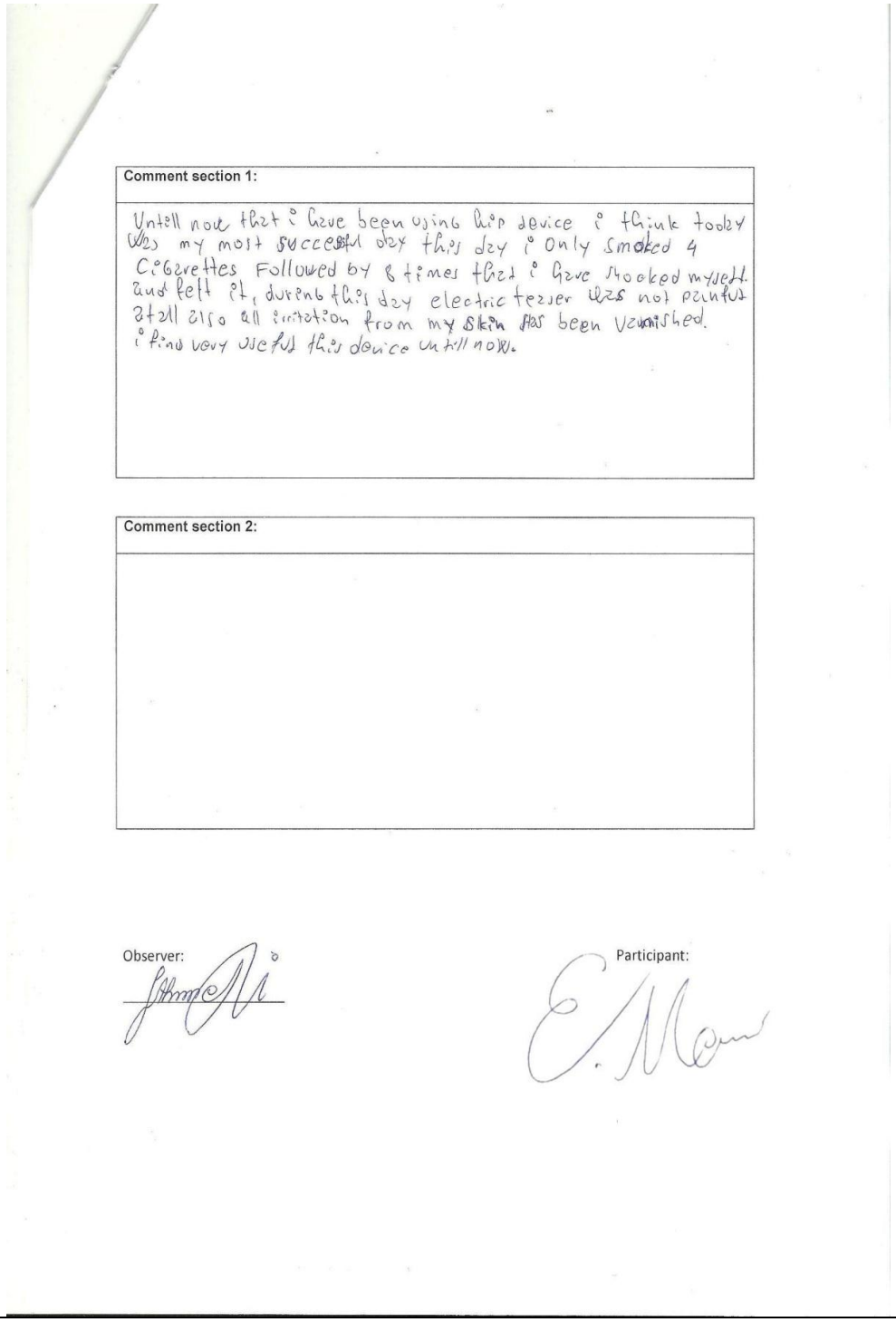
SURVEY OF HABIT CHANGING OVER HIP DEVICE

Place:	Gjilan	**Date:**	09.02.2017
Title:	Breaking smoking habit in five day period		
Participant:	Edona Memini		

Please complete the following questionnaire with specific regard to the above enquiry, by placing a CROSS in the appropriate box [X]

	Less than 3	Between 3-5	Between 6-9	10 to 15	16 or more
1. How many cigarettes I smoked today	☐	☒	☐	☐	☐
2. How many times I press the "Shock" button	☐	☐	☒	☐	☐
3. How manyhours I need to charge device today	☒	☐	☐	☐	☐
4. How many hours I have not use hip device today	☐	☐	☐	☒	☐

	Yes	No	Little
5. Was electric teaser painful	☐	☒	☐
6. Did electric teaser cause you any skin irritation	☐	☒	☐
7. Was it easy to carry	☒	☐	☐
8. Did you take device with you outside home	☒	☐	☐
9. do you have any difficulties to zip/unzip hip device	☐	☒	☐



Comment section 1:

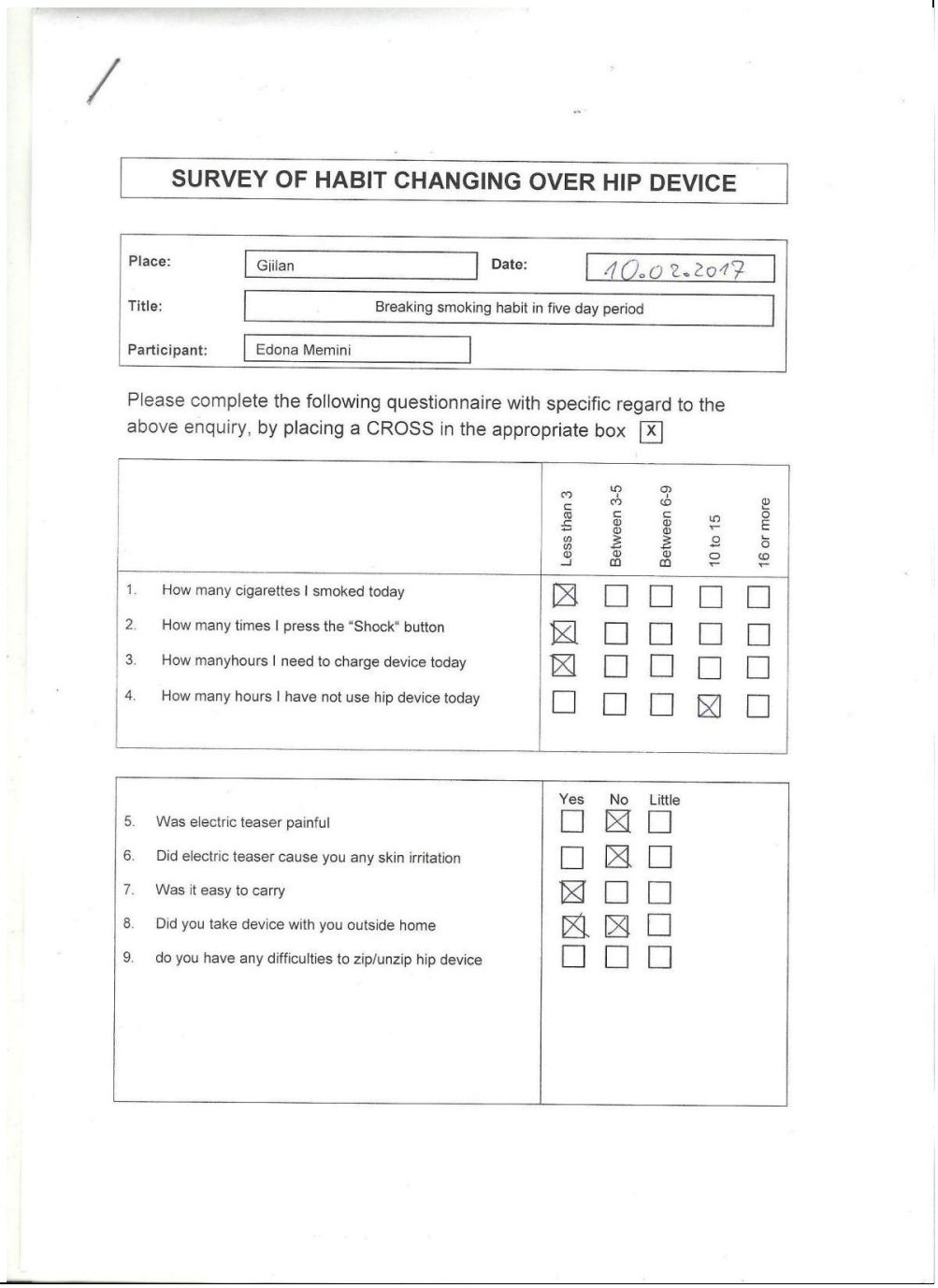
Untill now that i have been using this device i think today was my most succesful day this day i only smoked 4 Cigerettes Followed by 8 times that i have smooked myself. and felt it, during this day electric tezer was not painful at all also all irritation from my skin has been vanished. i find very useful this device untill now.

Comment section 2:

Observer:

Participant:

Day5



SURVEY OF HABIT CHANGING OVER HIP DEVICE

Place:	Gilan	Date:	10.02.2017
Title:	Breaking smoking habit in five day period		
Participant:	Edona Memini		

Please complete the following questionnaire with specific regard to the above enquiry, by placing a CROSS in the appropriate box [X]

	Less than 3	Between 3-5	Between 6-9	10 to 15	16 or more
1. How many cigarettes I smoked today	☒	☐	☐	☐	☐
2. How many times I press the "Shock" button	☒	☐	☐	☐	☐
3. How manyhours I need to charge device today	☒	☐	☐	☐	☐
4. How many hours I have not use hip device today	☐	☐	☐	☒	☐

	Yes	No	Little
5. Was electric teaser painful	☐	☒	☐
6. Did electric teaser cause you any skin irritation	☐	☒	☐
7. Was it easy to carry	☒	☐	☐
8. Did you take device with you outside home	☒	☒	☐
9. do you have any difficulties to zip/unzip hip device	☐	☐	☐

Hip device code description

In this section I have included low level programming code that we have used to program device.

This is the first class called “Menu” and here we have declared variables, external devices such display, buttons, sensors. Current figure displays beginning of code button declaration Bluetooth pin for receive and transmit data over mobile phone also we have defined variables for smoke sensor and give current values also hear rate sensor.

Menu § | Interrupt

```
#include "U8glib.h"
#include <SoftwareSerial.h>
U8GLIB_SSD1306_128X64 u8g(U8G_I2C_OPT_DEV_0|U8G_I2C_OPT_NO_ACK|U8G_I2C_OPT_FAST);

#define KEY_NONE 0
#define KEY_PREV 1
#define KEY_NEXT 2
#define KEY_SELECT 3
#define KEY_BACK 4

int rxPin = 5;
int txPin = 6,btPin=9;

bool btMode = false;
bool smodeMode = false; int somedelay=0;
bool hrMode = false;

uint8_t uiKeyPrev = 7;
uint8_t uiKeyNext = 3;
uint8_t uiKeySelect = 4;
uint8_t uiKeyBack = 5;

uint8_t uiKeyCodeFirst = KEY_NONE;
uint8_t uiKeyCodeSecond = KEY_NONE;
uint8_t uiKeyCode = KEY_NONE;

float Ro = 10000.0;    // this has to be tuned 10K Ohm
int sensorPin = 1;  // select the input pin for the sensor
int val = 0;        // variable to store the value coming from the sensor
float Vrl = 0.0;
float Rs = 0.0;
float ratio = 0.0;

SoftwareSerial mySerial(10,11);
//heart rate



// Sensor and pins variables
int pulsePin = 0;

// Create aREST instance
```

Current image displays definition of given value for heart rate algorithm and function uiStep() that link button to negative value on press that we will need later for navigation on the program.	Menu § Interrupt
	
	// Pulse rate variable
	volatile int BPM;
	
	// Exposed pulse rate variable
	int measured_bpm;
	
	// Raw signal
	volatile int Signal;
	
	// Interval between beats
	volatile int IBI = 600;
	
	// Becomes true when the pulse is high
	volatile boolean Pulse = false;
	
	// Becomes true when Arduino finds a pulse
	volatile boolean QS = false;
	
	void uiSetup(void) {
	  // configure input keys
	
	  pinMode(uiKeyPrev, INPUT_PULLUP); // set pin to input with pullup
	  pinMode(uiKeyNext, INPUT_PULLUP); // set pin to input with pullup
	  pinMode(uiKeySelect, INPUT_PULLUP); // set pin to input with pullup
	  pinMode(uiKeyBack, INPUT_PULLUP); // set pin to input with pullup
	}
	
	void uiStep(void) {
	  uiKeyCodeSecond = uiKeyCodeFirst;
	  if (digitalRead(uiKeyPrev) == LOW)
	  uiKeyCodeFirst = KEY_PREV;
	  else if (digitalRead(uiKeyNext) == LOW)
	  uiKeyCodeFirst = KEY_NEXT;
	  else if (digitalRead(uiKeySelect) == LOW)
	  uiKeyCodeFirst = KEY_SELECT;
	  else if (digitalRead(uiKeyBack) == LOW)
	  uiKeyCodeFirst = KEY_BACK;
	  else
	  uiKeyCodeFirst = KEY_NONE;
	
	  if (uiKeyCodeSecond == uiKeyCodeFirst)
	  uiKeyCode = uiKeyCodeFirst;
	  else
	  uiKeyCode = KEY_NONE;

Current image displays fragment of code that defines main menu items on desktop which are “Heart rate”,”Smoke Sensor”,”Bluetooth” and their symbol to be displayed. Function DravMenu() and drawDesktop() gets data from display “u8g library” such as font name, font height, length of items to be displayed, background color and other display parametres.	Menu § Interrupt
	
	`#define MENU_ITEMS 4`
	`#define DESKTOP_ITEMS 3`
	`const char *menu_strings[MENU_ITEMS] =`
	`{ "Heart Rate", "Smoke Sensor", "Bluetooth", "Back" };`
	`const char *desktop_strings[DESKTOP_ITEMS] = { "H", "S", "B" };`
	
	`uint8_t menu_current = 0;`
	`uint8_t menu_redraw_required = 0,desktop_redraw_required=0,stateView=0;`
	`uint8_t last_key_code = KEY_NONE;`
	
	`void drawMenu(void) {`
	`  uint8_t i, h;`
	`  u8g_uint_t w, d;`
	
	`  u8g.setFont(u8g_font_6x13);`
	`  u8g.setFontRefHeightText();`
	`  u8g.setFontPosTop();`
	
	`  h = u8g.getFontAscent()-u8g.getFontDescent();`
	`  w = u8g.getWidth();`
	`  for( i = 0; i < MENU_ITEMS; i++ ) {`
	`  d = (w-u8g.getStrWidth(menu_strings[i]))/2;`
	`  u8g.setDefaultForegroundColor();`
	`  if ( i == menu_current ) {`
	`  u8g.drawBox(0, i*h+1, w, h);`
	`  u8g.setDefaultBackgroundColor();`
	`  }`
	`  u8g.drawStr(d, i*h, menu_strings[i]);`
	`  }`
	`}`
	
	`void drawDesktop(void) {`
	`  uint8_t i, h,h1;`
	`  u8g_uint_t w, d;`
	
	`  u8g.setFont(u8g_font_6x13);`
	`  u8g.setFontRefHeightText();`
	`  u8g.setFontPosTop();`
	
	`  h = u8g.getFontAscent()-u8g.getFontDescent();`
	`  w = u8g.getWidth();`
	`  h1 =  u8g.getHeight();`

Except display settings and design in this image is displayed fragment from algorithm that calculate smoke pollution level by using default values given by original manufacturer.

Menu § | Interrupt

```
    //heart rate icon

     h = (h1 -(u8g.getFontAscent()-u8g.getFontDescent()))/2;
     d = (w-u8g.getStrWidth("HIP"))/2;
      u8g.drawStr(d, h, "HIP");


    if(hrMode) {
       h = h1 -(u8g.getFontAscent()-u8g.getFontDescent());
      u8g.drawStr(0, h, desktop_strings[0]);

    }
    else  u8g.drawStr(0, h, " ");

    if(smodeMode) {
       d = (w-u8g.getStrWidth(desktop_strings[1]));
       h = h1 -(u8g.getFontAscent()-u8g.getFontDescent());
       u8g.drawStr(d, h, desktop_strings[1]);
    }
    else u8g.drawStr(d, h, " ");

    if(btMode) {

       h = h1 -(u8g.getFontAscent()-u8g.getFontDescent());
      u8g.drawStr(0, 0, desktop_strings[2]);
       digitalWrite(btPin,LOW);
    } else { u8g.drawStr(0, 0, " ");    digitalWrite(btPin,HIGH); }

}


// get CO ppm
float get_CO (float ratio){
  float ppm = 0.0;
  ppm = 37143 * pow (ratio, -3.178);
return ppm;
}

void updateMenu(void) {
  if ( uiKeyCode != KEY_NONE && last_key_code == uiKeyCode ) {
    return;
  }
  last_key_code = uiKeyCode;
```

This code shows navigation bar that takes effect on moving cursor from one element to another, using break, case method.

Menu § | Interrupt

```
  switch ( uiKeyCode ) {
   case KEY_NEXT:
   if(stateView==1) {
      menu_current++;
      if ( menu_current >= MENU_ITEMS )
        menu_current = 0;
        Serial.println("Next");
      menu_redraw_required = 1;
   }
      break;
    case KEY_PREV:
    if(stateView==1) {
      if ( menu_current == 0 )
        menu_current = MENU_ITEMS;
      menu_current--;
      Serial.println("Next");
      menu_redraw_required = 1;
    }
      break;
       case KEY_SELECT:
      stateViewFn();

      break;
  }
}

void stateViewFn() {

   switch(stateView) {

   case 0:
   menu_redraw_required=1;
   stateView=1;
   break;

   case 1:
    switch(menu_current) {
      case 0:
      hrMode = !hrMode;
      break;
       case 1:
      smodeMode = !smodeMode;
      break;
      case 2:
```

In this image we find smoke() function which using previous sketch converts analog values to Volt with given resistance to get samples from environment as correct as possible, also you can notice myserial.print("H"+String(measured)); ths function is responsible for displaying Heart rate value with prefix "H" that later we can pick out from android software.	Menu § Interrupt
	desktop_redraw_required=1;
	stateView=0;
	menu_current=0;
	}
	}
	void smoke() {
	val = analogRead(sensorPin); // read the value from the analog sensor
	Vrl = val * (3.7 / 1024.0); // V
	Rs = 20000 * (3.7 - Vrl) / Vrl ; // Ohm
	ratio = Rs/Ro;
	mySerial.print("S"+String(get_CO(ratio)));
	}
	void setup() {
	mySerial.begin(38400);
	pinMode(btPin,OUTPUT);
	u8g.setRot180();
	digitalWrite(btPin,HIGH);
	uiSetup(); // setup key detection and debounce algorithm
	desktop_redraw_required = 1;
	interruptSetup();
	}
	void OnOff () {
	int measured = BPM;
	if(hrMode) {
	if (QS == true) {
	mySerial.print("H"+String(measured));
	else {
	delay(200);
	}
	QS = false;

In this image we have displayed different function that helps desktop for easy navigation and saves given position.	

Menu § Interrupt

```
      }
    QS = false;

  delay(20);
  }
  }
}
void loop() {



  OnOff();
  if(smodeMode==true)
  {
    if(somedelay>500) {
    somedelay=0;
    smoke();
    } else somedelay++;

  }

 uiStep();                                    // check for key press


  if ( stateView==0 && desktop_redraw_required != 0 ) {
    u8g.firstPage();
    do  {
      drawDesktop();

    } while( u8g.nextPage() );
    desktop_redraw_required = 0;
  }

  else if ( stateView==1 && menu_redraw_required != 0 ) {
    u8g.firstPage();
    do  {
      drawMenu();
    } while( u8g.nextPage() );

    menu_redraw_required = 0;
  }
  updateMenu();                          // update menu bar

}
```

This image shows “interrupt” class this class is responsible for, heart rate calculation all code in this class is given as template from heart sensor manufacturer, but we have to change some of the values to adapt with given sensor. Each fragment of code comes with explanation that makes very easy for understanding by user.

Menu § | Interrupt

```
volatile int rate[10];                    // array to hold last ten IBI values
volatile unsigned long sampleCounter = 0; // used to determine pulse timing
volatile unsigned long lastBeatTime = 0;  // used to find IBI
volatile int P =512;                      // used to find peak in pulse wave, seeded
volatile int T = 512;                     // used to find trough in pulse wave, seeded
volatile int thresh = 512;                // used to find instant moment of heart beat, seeded
volatile int amp = 100;                   // used to hold amplitude of pulse waveform, seeded
volatile boolean firstBeat = true;        // used to seed rate array so we startup
volatile boolean secondBeat = false; // used to seed rate array so we startup
                                                        with reasonable BPM
                                                        with reasonable BPM
void interruptSetup(){
  // Initializes Timer2 to throw an interrupt every 2mS.
  TCCR2A = 0x02;     // DISABLE PWM ON DIGITAL PINS 3 AND 11, AND GO INTO CTC MODE
  TCCR2B = 0x06;     // DON'T FORCE COMPARE, 256 PRESCALER
  OCR2A = 0X7C;      // SET THE TOP OF THE COUNT TO 124 FOR 500Hz SAMPLE RATE
  TIMSK2 = 0x02;     // ENABLE INTERRUPT ON MATCH BETWEEN TIMER2 AND OCR2A
  sei();             // MAKE SURE GLOBAL INTERRUPTS ARE ENABLED
}


// THIS IS THE TIMER 2 INTERRUPT SERVICE ROUTINE.
// Timer 2 makes sure that we take a reading every 2 miliseconds
ISR(TIMER2_COMPA_vect){                   // triggered when Timer2 counts to 124
  cli();                                  // disable interrupts while we do this
  Signal = analogRead(pulsePin);          // read the Pulse Sensor
  sampleCounter += 2;                     // keep track of the time in mS with this variable
  int N = sampleCounter - lastBeatTime; // monitor the time since
                                           the last beat to avoid noise

    //  find the peak and trough of the pulse wave              3/5 of last IBI
  if(Signal < thresh && N > (IBI/5)*3){       // avoid dichrotic noise by waiting
    if (Signal < T){                        // T is the trough
      T = Signal;                           // keep track of lowest point in pulse wave
    }
  }

  if(Signal > thresh && Signal > P){          // thresh condition helps avoid noise
    P = Signal;                              // P is the peak
  }                                          // keep track of highest point in pulse wave
```

Menu § Interrupt

```
//  NOW IT'S TIME TO LOOK FOR THE HEART BEAT
// signal surges up in value every time there is a pulse
if (N > 250){
  if ( (Signal > thresh) && (Pulse == false) && (N > (IBI/5)*3) ){
    Pulse = true;
    IBI = sampleCounter - lastBeatTime;
    lastBeatTime = sampleCounter;

    if(secondBeat){
      secondBeat = false;
      for(int i=0; i<=9; i++){
        rate[i] = IBI;
      }
    }

    if(firstBeat){
      firstBeat = false;
      secondBeat = true;
      sei();
      return;
    }


    // keep a running total of the last 10 IBI values
    word runningTotal = 0;

    for(int i=0; i<=8; i++){
      rate[i] = rate[i+1];
      runningTotal += rate[i];
    }

    rate[9] = IBI;
    runningTotal += rate[9];
    runningTotal /= 10;
    BPM = 60000/runningTotal;
    QS = true;
    // QS FLAG IS NOT CLEARED INSIDE THIS ISR
  }
}
```

Menu § Interrupt

```
      }


      // keep a running total of the last 10 IBI values
      word runningTotal = 0;

      for(int i=0; i<=8; i++){
        rate[i] = rate[i+1];
        runningTotal += rate[i];
      }

      rate[9] = IBI;
      runningTotal += rate[9];
      runningTotal /= 10;
      BPM = 60000/runningTotal;
      QS = true;
      // QS FLAG IS NOT CLEARED INSIDE THIS ISR
    }
  }

  if (Signal < thresh && Pulse == true){
    Pulse = false;
    amp = P - T;
    thresh = amp/2 + T;
    P = thresh;
    T = thresh;
  }

  if (N > 2500){
    thresh = 512;
    P = 512;
    T = 512;
    lastBeatTime = sampleCounter;
    firstBeat = true;
    secondBeat = false;
  }

  sei();
}// end isr
```