Faculty of Engineering

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Systems and Biomedical Engineering Department

Measurements

Report

Group 13:

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Introduction

We always worry about an Alzheimer patient, as he probably does not know what he is doing sometimes, what he wants to do or what he was doing. He may lose himself suddenly so he is always in danger from many things and he can not live his own life without help from someone who really cares about him.

So what if there is a smart system that can take care of him and help him to live his life normally almost without any help from anyone.
It will be like a magical solution for him and for anyone who cares about him

That is what our project aims for; by using some sensors and a mobile application linking his home with the caregiver and the patient.

Theory of operation

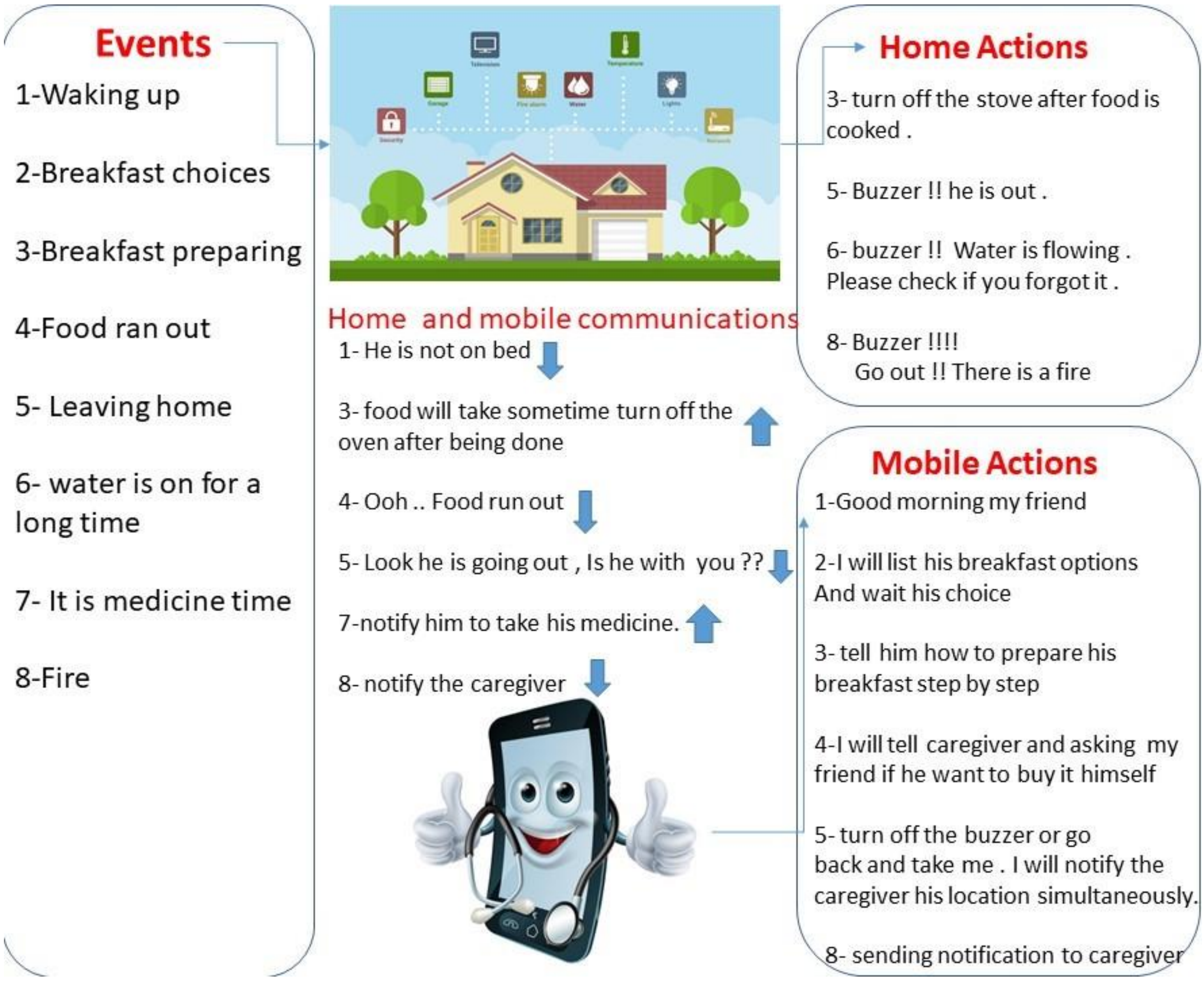
Alzheimer's patients suffer from memory loss, forgetfulness and sometimes confusion with their surroundings or what they were doing. Consequently, they are unable to live entirely on their own. Our system aims to give them independence and the ability to live their lives on their own to a large extent.

By the use of an android application present in a smart watch that is always worn by the patient; we would be able to monitor the patient's activities from the moment he wakes up. We also used a multitude of sensors built in his home that tie with the android application. The android app represents a constant companion to the patient that greets him in the morning and offers him choices of breakfast. The app connects with the oven by a timer according to his choice.

When the patient tries to leave the house, the app reminds him not to forget his watch, it also sends the GPS location to the caregiver and a buzzer sounds. If the food from the fridge runs out, a notification is sent to the caregiver or the grocer's. If its time for his medicine a notification is sent to the patient and a buzzer sounds beside the medicine to let him know where it is.

The app allows the patient to make a to-do list for things he wants to dobut might forget.Also, the sensors in the house give a buzzer sound if the patient left the water flowing for more than a certain amount of time and if there is a fire it also sends a notification to the caregiver.

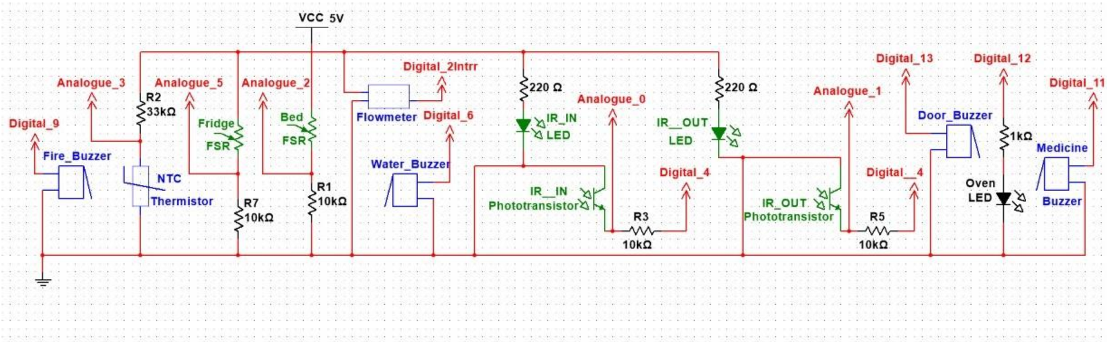
Block Diagram



COMPONENTS

1. NTC Thermistor
2. Buzzers
3. Push Buttons
4. Arduino & Bluetooth module
5. FSR
6. Flowmeter
7. IR emitter-detector pairs
8. Macquette
9. Android application

Circuit Diagram



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Calculations for thermistor

Theoretical temperature = 24.1°C

Mean Temperature = 23.09286 °C

Absolute error = Mean – theoretical = 1.00714°C

Relative error = $\frac{Mean - theoretical}{theoretical} \times 100$

$= \frac{1.00714}{24.1} \times 100 = 4.17\%$

Relative accuracy = 1 – relative error

= 1 – 4.17 = 95.83 %

Max precision = Max – Mean

= 23.11 – 23.09286 = 0.01714°C

Min precision = Mean – Min

23.09286 – 23.07 = 0.02286°C

i	T(i)		T(i)-Mean
1	23.09		0.00
2	23.09		0.00
3	23.07		-0.02
4	23.09		0.00
5	23.09		0.00
6	23.09		0.00
7	23.09		0.00
8	23.09		0.00
9	23.09		0.00
10	23.11		0.02
11	23.11		0.02
12	23.11		0.02
13	23.09		0.00
14	23.09		0.00
Mean =	23.09286	Std. Dev. =	0.01

$$u_r^2 = \sum_{i=1}^{J} \theta_i{}^2 S_{B_i}^2 + 2\sum_{i=1}^{J-1} \sum_{j=i+1}^{J} \theta_i \theta_j S_{B_i,B_j} + \sum_{i=1}^{J} \theta_i{}^2 S_{P_i}^2 + 2\sum_{i=1}^{J-1} \sum_{j=i+1}^{J} \theta_i \theta_j S_{P_i,P_j},$$

Where

$$S_{P_i}^2 = \sum_{k=1}^{M_P} (S_{P_i})_k^2,$$

B relating to systematic and P relating to random. And since there is no dependency we can neglect the covariance term. And theta is the sensitivity coefficient from the equation used.

Therefore, ur = $\Theta \times$ Sp , where Sp = Px is $P_{\bar{x}} = t_{\nu_{P_x},C} \cdot S_{P_{\bar{x}}} = t_{\nu_{P_x},C} \cdot S_{P_x}/\sqrt{N}.$

V= N – 1, N is number of measurements.

Equation used is : Temp = $\left(\frac{1}{298.5} + \frac{\log\left(\frac{R_{th}}{R_o}\right)}{\beta} \right)^{-1}$ - 273.5

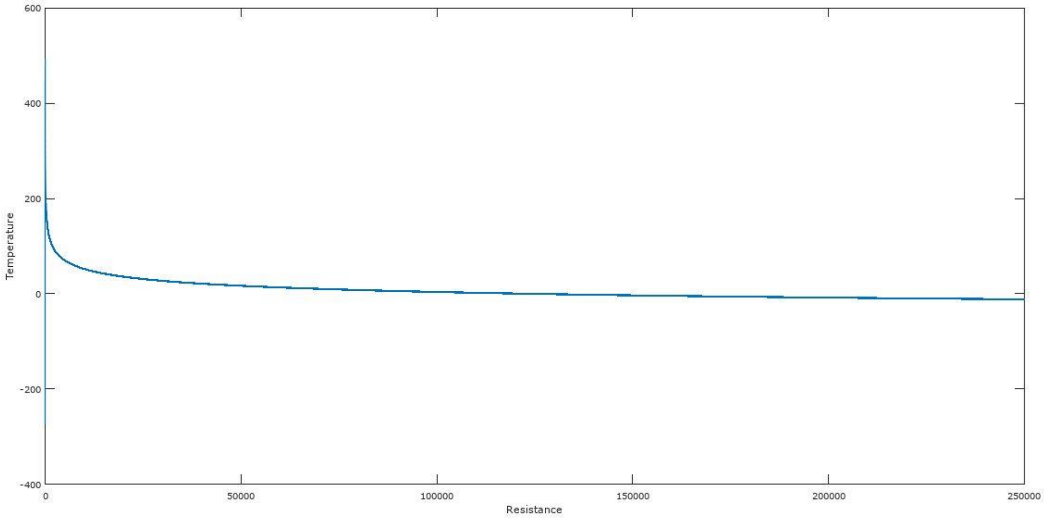
Therefore $\Theta = \frac{dTemp}{dR_{th}} = -(\frac{1}{298.5} + \frac{\log(\frac{35.1}{33})}{4299.52})^{-2} \times \frac{33}{35.1 \times 33000 \times 4299.52}$ = -5.8823$\times 10^{-4}$

Using a confidence level of 95%, t approximately = 2 as $V_{eff} > 9$

Px = $2 \times \frac{0.01}{\sqrt{14}} = 5.3452 \times 10^{-3}$

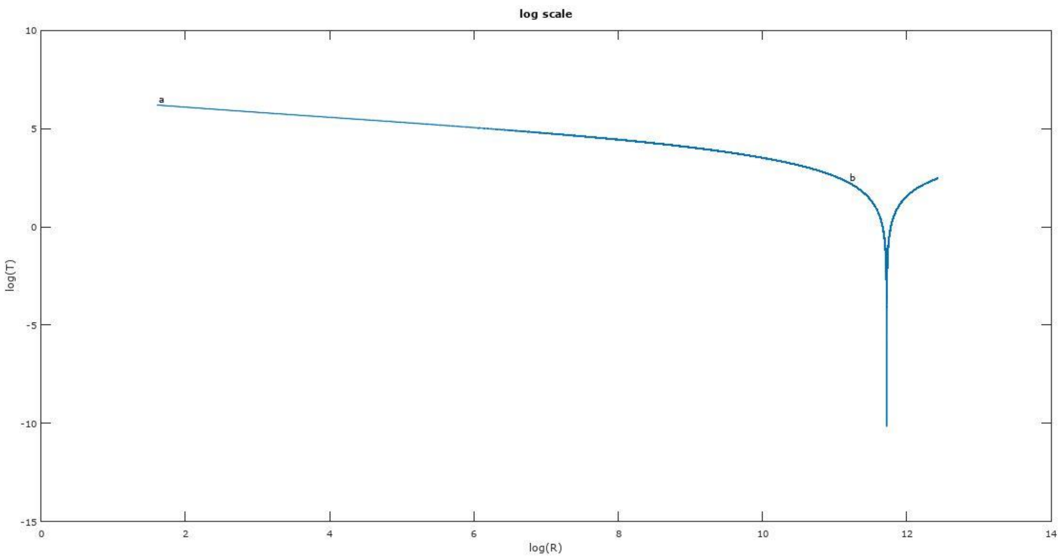
Ur = 3.1442×10^{-6}

Calculating sensitivity using Matlab to graph the equation mentioned above



To specify the slope in the range in which we used our thermistor

Drawing the graph in the log scale



Slope between "a" and "b" :-
sensitivity = $\frac{6..1268-2.1405}{11.207-1.6322} = 0.39298$