Lie Detector using MATLAB, Arduino and Biomedical Sensors

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Abstract - *Generally the crime punishes itself, but it desen't means that the criminal should be left unpunished. The rate of commitment of crime in our country is increasing exponentially. The question arises that what is the reason behind it? Is the judiciary of our nation weekend or the crimes are not illegal anymore? No, the reasons for the increased crime rates in our nation is the presence of loopholes in our judicial system. The culprit commits the crime and moves away with it without getting the punishment. This is the most heart-breaking part of the crime. Our lie detector using MATLAB and biometric sensors might act as a filter between truth and lies. Due to which we are proposing a project using BPM and temperature sensor to detect lies. Our proposed project will take input from sensors and process it and give output on LCD, LED, buzzer and MATLAB.*

Key Words: Final year project, LM35, BPM, Arduino ide, Simulink, Result

1. INTRODUCTION

For our final year project, we are designing an experimental setup for lie detection using MATLAB. Here we are using two sensors first one is a blood pressure monitor sensor (B.P.M) and the other one is the temperature sensor and we sample the output data from the two sensors. The LM35 temperature sensor will measure the body temperature of the individual by the help of skin contact. The second sensor is the BPM sensor which will measure the beats per minute of the individual and display the output on the LCD. These two sensors will be used to assemble the lie detector. After the assembling we will initially gather data from a group of volunteers. We will also design a Simulink model and a Simulink program so that we can serially communicate to the lie detector with the MATLAB and then digitally acquire the Real-time readings on the MATLAB Simulink model. The hardware reading can be seen on the liquid crystal display (LCD). We took both hardware and software readings for the purpose of calibration of the device. So, after getting both the readings we can calibrate the device. All the measurement such as temperature and blood pressure are compared to the normal reading of any individual. The lm35 is mounted on a wrist band and then placed on the wrist of the individual. The BPM is taken using an infrared sensor is mounted on the fingertip. The reading can also be observed at the serial window of the Arduino ide (integrated development environment).

2. LITRATURE SURVEY

Research [1] has been conducted where a lie detector was made using GSR and Heart rate sensor and LAB VIEW from NI but the GSR output was quite unstable since sweating vary drastically from person to person so it can't be a parameter for comparisons.

More research [2] has been conducted on the serial communication between Arduino UNO and MATLAB Simulink about its accuracy and dependence.

More research [3] has been conducted with reference of the text book "The Polygraph and Lie Detection "by Mark Moore that how does lie detection process works.

Next reserch [4] has been conducted a lie detector was made using Arduino and TMP36 temperature sensor the project was working but we used LM35 since The LM35 boasts a slightly higher temperate range at -55℃ to 150℃ versus the -40℃ to 125℃ range of the TMP36.

3. SYSTEM DESIGN

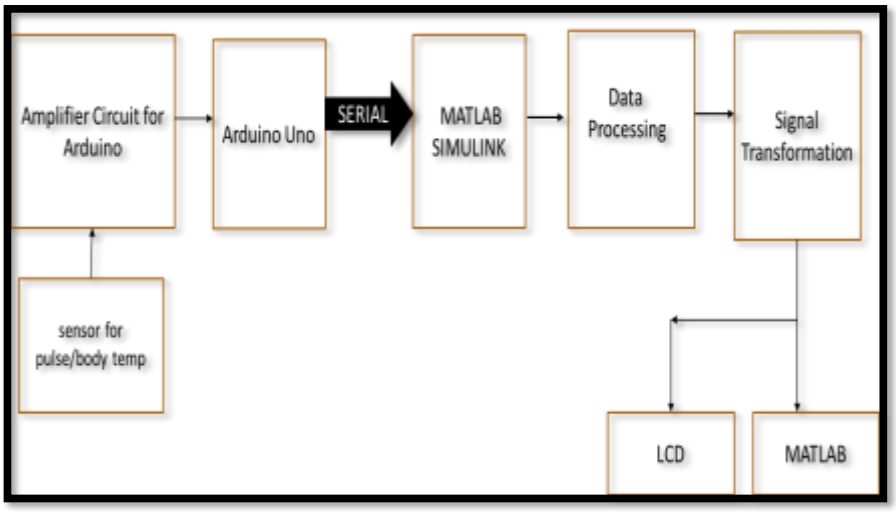

Figure 1: System Design

3.1 HARDWARE DESIGN

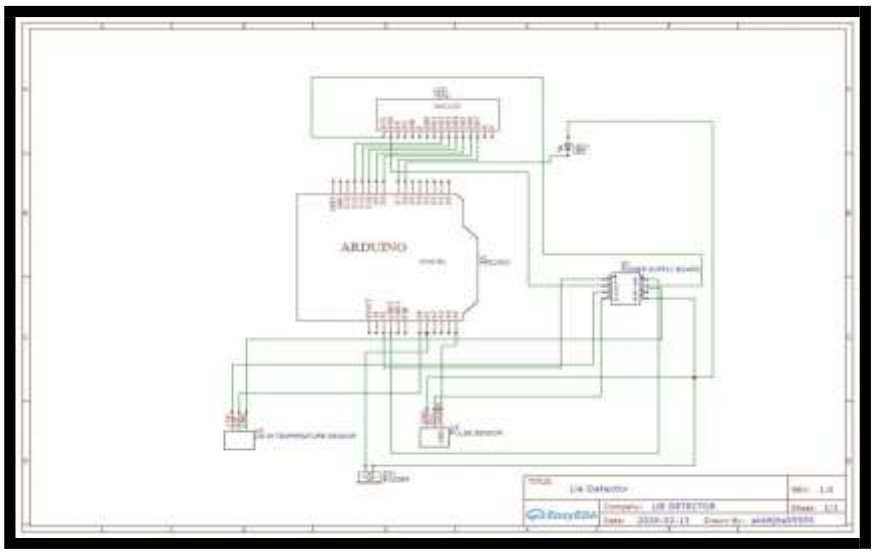

Figure 2: Hardware System Design

LM 35

LM35 is a temperature sensor. The output voltage is directly proportional to temperature and for every 10mv there is increase in 1-degree celcius. It does not require any external calibration; it is calibrated to degree celcius. It is a linear sensor and operates from 4v to 30 v.

BPM Sensor Module

The BPM sensor senses the heart beats per minute, this is done using optical method. The sensor is placed at the fingertip since the rate of change in vascular level of blood is high at the finger tips. When the density of blood at fingertip changes, the infrared light catches the rate of change in blood density and is amplified by an amplifier circuit and then passed on to the analog pins of the Arduino

Arduino

Arduino is a microcontroller development board containing ATMEGA328 microcontroller. It consists of 14 digital pins (d0 – d13) and 6 analog pins (a0 – a5). Programing in Arduino is done in embedded c language. It is a single board microcontroller and has Static Random-Access Memory (SRAM) memory. It has storage of flash or EEPROM.

LCD

LCD stands for liquid crystal display. It is an output device used to display output. They are commonly used in LED TV, smart phone and instrument panels. It has a total of 16 pins, here we will interface the LCD in 4 – bit mode. It has a register select pin which when low the input is command and when high the input is data. The read and write pin when low write to LCD and when high read from LCD. The last configuration pin is enabling pin which should come from high too low for writing to LCD.

3.2 SOFTWARE DESIGN

Simulink

Simulink is a MATLAB simulation tool developed by math work. We would need the Arduino package, Simulink package and legacy package to interface the Arduino using MATLAB(R2018). The communication between MATLAB and Simulink is done with the help of serial communication. The serial communication port is used to communicate Arduino and MATLAB.

Arduino IDE

It is basically an open source software used to program Arduino microcontroller board. The programming is done in embedded c language. The IDE contains serial window and serial monitor to see the Real-time output of the system.

4. IMPLEMENTATION

The implementation of our project is done using Arduino UNO (ATMEGA 328) microcontroller development board. The LM35 temperature sensor is in contact with the skin of the individual and when the temperature rises, the LM35 module gives output in the form of output analog voltage. Similarly, when the BPM sensor is connected to the fingertip of the individual and it has two sides, a side for LED and other for amplifying circuitries detects the BPM and again gives output in analog form. The output of both sensors is fed to the analog pins of Arduino Uno and the digital pins of the Arduino are connected to LCD. The ADC (analog to digital converter) in Arduino convert analog signal to digital form and then display it on LCD. Both temperature and BPM has a fixed threshold and whenever temperature or BPM crosses the threshold the buzzer beeps and LED blinks. Now coming to the implementation of software parts of the project. The Arduino and Simulink are connected through serial communication port. On the Simulink model the real time reading is taken from Arduino through serial communication port at 9600 baud rates. The output of Simulink model is plotted on graph simultaneously for both the sensors.

4.1 HARDWARE IMPLEMENTATION

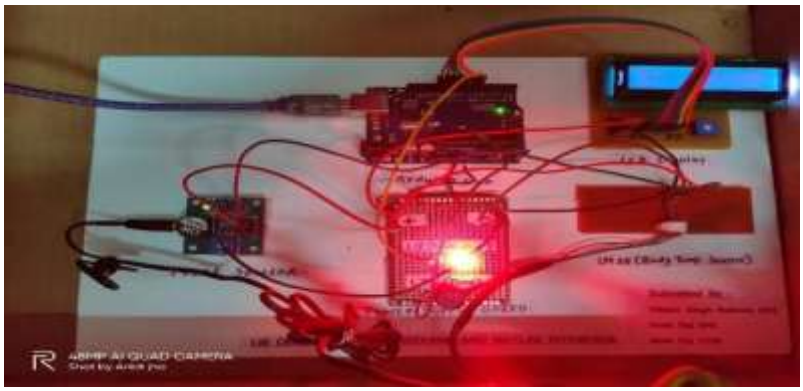

Figure 3: Hardware implementation

4.2 SOFTWARE IMPLEMENTATION

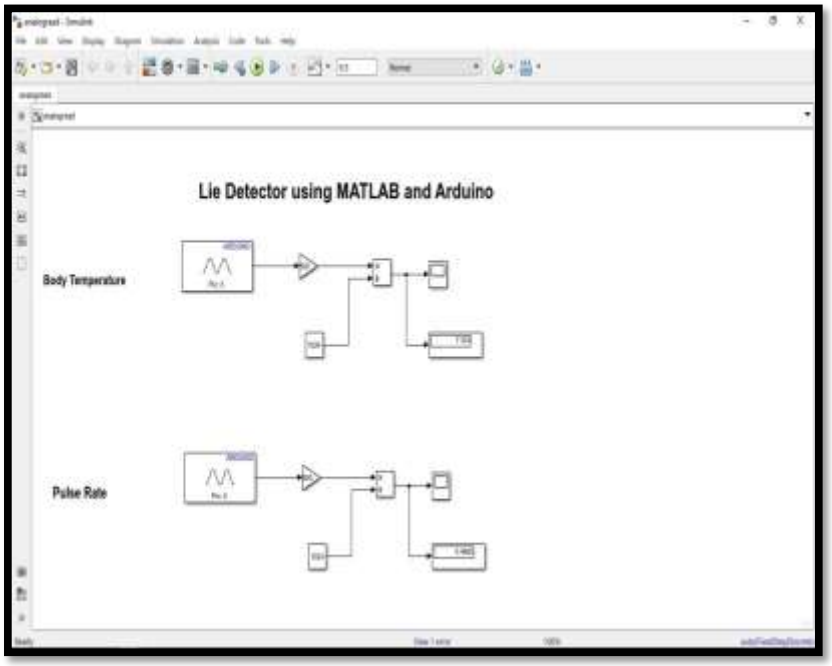

Figure 4: Software implementation

5. RESULT AND OUTPUT ANALYSIS

The project when implemented produces various outputs using various inputs from the sensors which are shown in the table 1.

INPUT	OUTPUT
Temperature Sensor	It detects the change in temperature in the individual's bodyand gives the output in the form of analog voltage.
BPM Sensor	It detects the change in BPM in the individual's body and gives the output in the form of analog voltage to the radio.

Table no: 1

5.1 HARDWARE AND SOFTWARE OUTPUT OF TEMPRATURE SENSOR

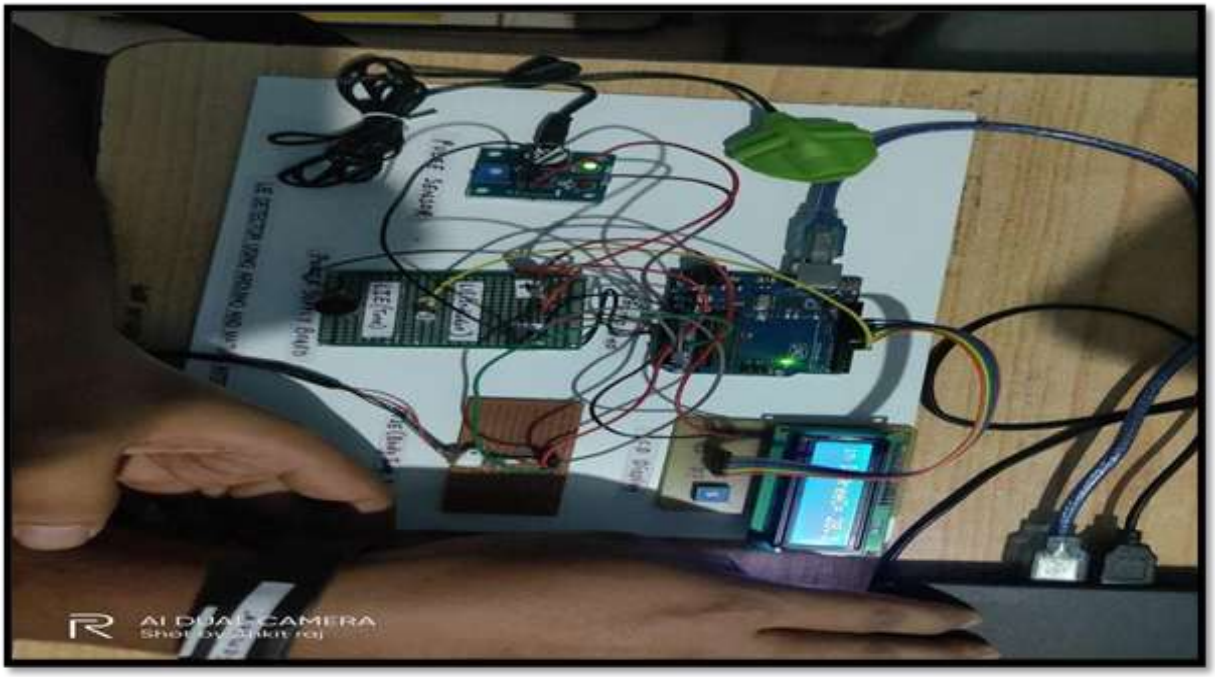

Figure 5: Temperature sensor hardware result

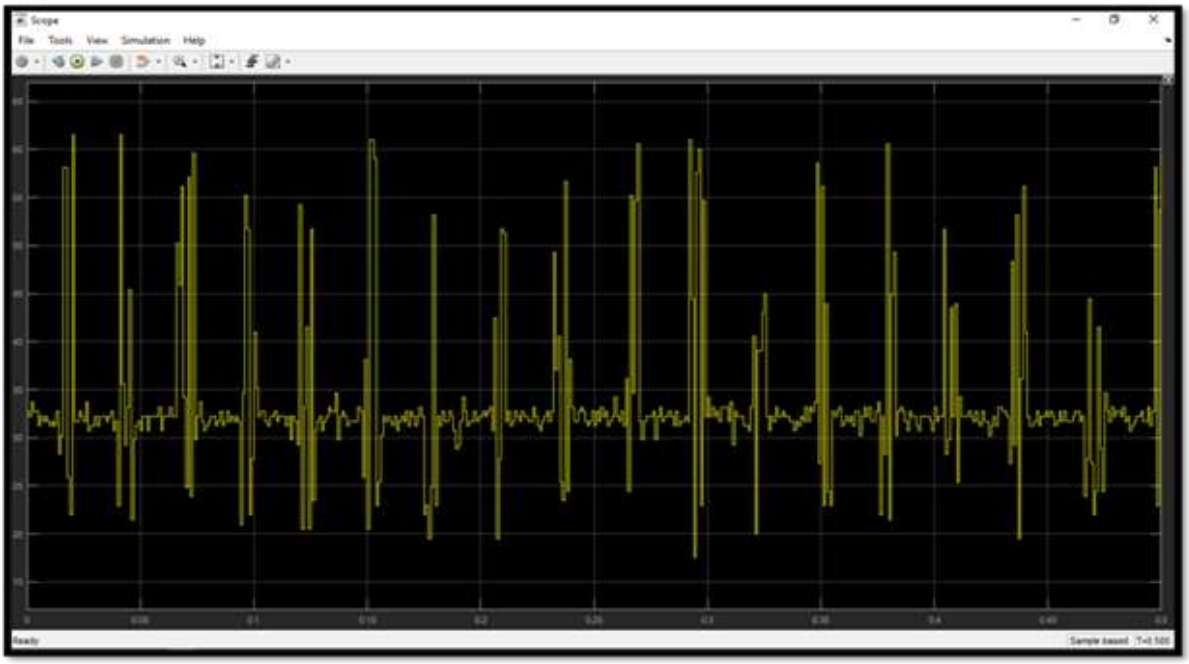

Figure 6: Temperature sensor Software result

6. HARDWARE AND SOFTWARE OUTPUT OF BPM SENSOR

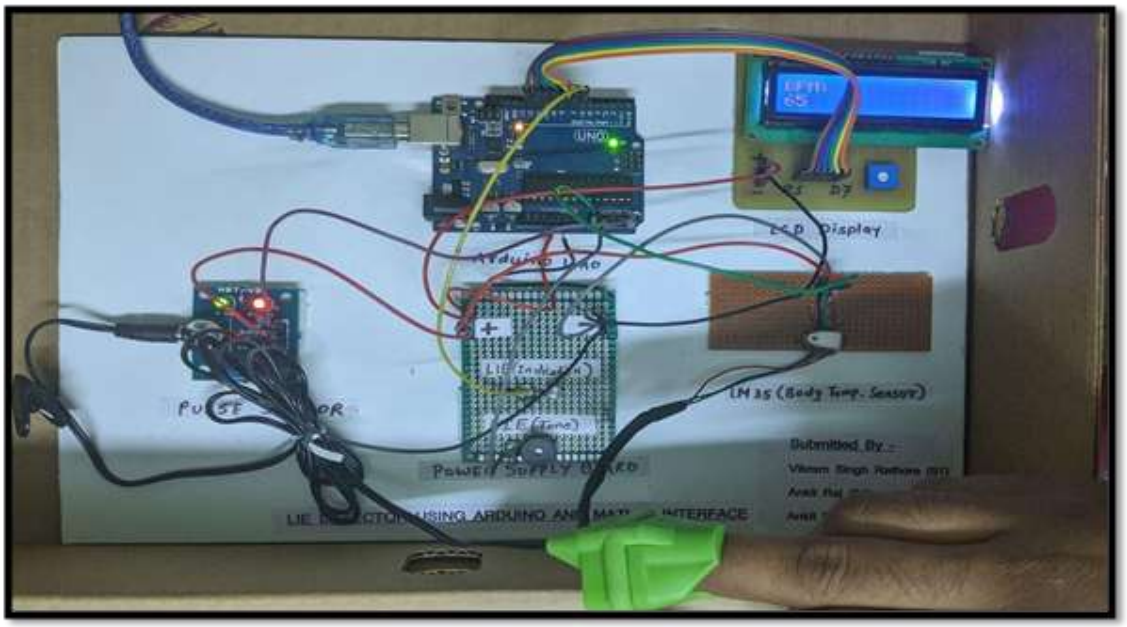

Figure 7: BPM sensor hardware result

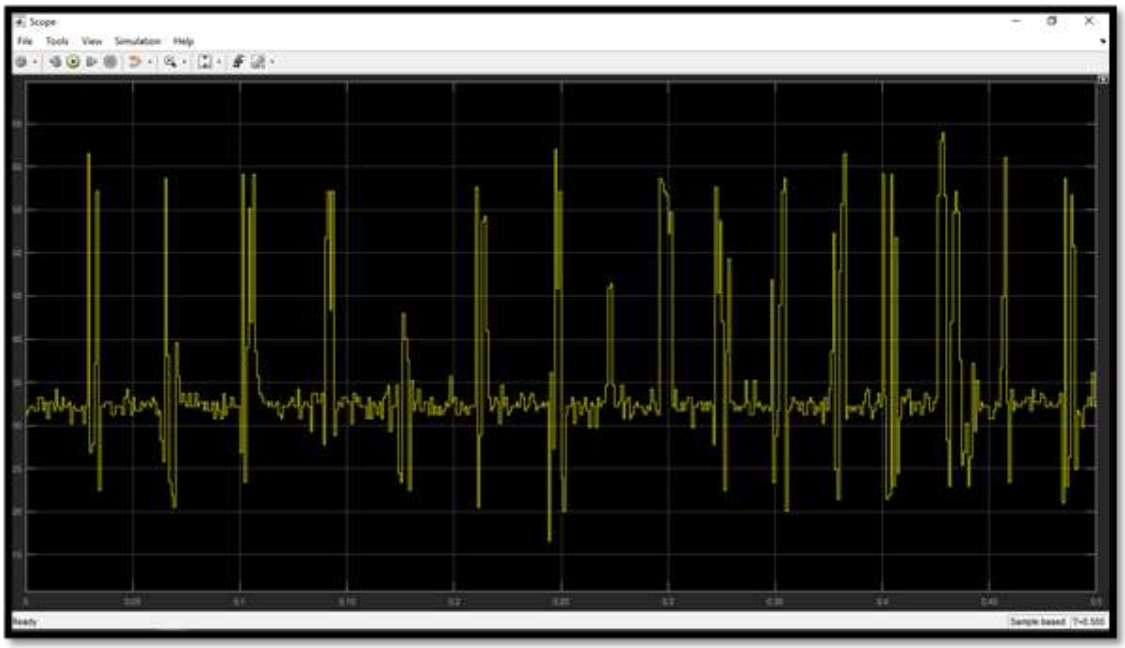

Figure 8: BPM sensor hardware result

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REFERENCES

[1] Akarsh Sinha, M. Pavithra, K.R. Sutharshan, "Arduino based pulse width modulated output voltage control of a dc- dc boost converter using PID strategy," unpublished.

[2] Calin Corciova, Radu Ciorap, Dan Zaharia and Daniela Matei, 2011. On Using Impedance Plethysmography for Estimation of Blood Flow, IEEE.

[3] Edward Sazonov, Timothy Haskew, Andrew Price, Bryant Grace and Stephanie Schuckers, 2012.

[4] Electronic and Electromechanical Tester of Physiological Sensors, Sixth International Conference on Sensing Technology (ICST).

[5] Introducing easy pulse: A diy photoplethysmographic sensor for measuring heart rate. (2012, September 12). Retrieved from http://embedded- lab.com/blog/?p=5508

[6] Geddes, L.A., 2002. Purdue University, The truth shall set you free: Development of the Polygrapgh, IEEE Engineering In Medicine and Biology.

[7] Hashem, M.M.A., Rushdi Shams, Md. Abdul Kader and Md. Abu Sayed, 2010. Design and Development of a Heart Rate Measuring Device using Fingertip, International Conference on Computer and Communication Engineering (ICCCE 2010), 11-13 May 2010, Kuala Lumpur, Malaysia.

[8] Programming Arduino: Getting Started with Sketches by SIAMON MONK

[9] The Polygraph and Lie Detection Book by Mark Moore

[10] https://en.wikipedia.org/wiki/Arduino_Uno

BIOGRAPHIES

PHOTOS	BIOGRAPHY
	Mr. Prasad D. Kadam is Assistant Professor in Department of Electronics and Telecommunication at B.V(D.U)C.O.E. Pune. He completed his M.Tech in Electronics. He was the project guide throughout the project.
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