Optimal Lie Detector using NI MyDAQ

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ABSTRACT: *Lie Detector is a very important in many areas where the security aspects are predominant. The place where the lie detector concept is being used arepolice investigations, counter-terrorism, airport security, etc. One procedure to detect lies is through the identification of certain changes in the facial expressions, which are brief and involuntary expressions shown on the face of humans.This thing happens whenever they are trying to repress or conceal their emotions. Actual measurement of facial micro-expressions is very hard, huge amount of time would be consumed, and can't be very accurate. The Development and Design of a Lie Detection System using Micro-Expressions of Face is crucial thing. It is an automatic visionary system implemented anddesigned using LabVIEW. An Embedded Vision System (EVS) will be used to capture the person's interview. There are four(4) consecutive stages. By using these stages, the LabVIEW softwarewill be able to converts the video into processes the framesand series of frames, each at a moment.*

The initial two stages will be dealing with filtering and color conversion. The latter stage i.e., third stage will applies dynamic templates which are geometric-based,on each frame to specify key features of the facial structure. The final stage i.e., fourth stage extracts the required computations in order to detect and find themicro-expressions of faceto determine whether the person is saying lies or not. Testing results shows that the actual design system is used for interpreting eight expressions of face: They arejoy, happiness, anger, sadness,surprise, fear, contempt and disgust and detecting micro-expressions of face. It gives correct results that can also be used in other fields of studies like psychological assessment. Thisresults gives high accuracy that allows to develop the future development in applications that responds to spontaneous expressions of face in real time world.

KEYWORDS: LIE DETECTION, NI MYDAQ, LABVIEW, GALVANIC SKIN RESISTANCE, SKIN SENSOR, EKG.

I. INTRODUCTION:

Lie detector(deception detector), which uses questioning techniques along with technology that finds and documents the physiological functions to ascertain falsehood and truth in output response. It is generally used by encryption fieldsand law enforcement. There are wide range of variety of technologies avail for this purpose. The most frequently used measure is the polygraph, which is considered by the U.S. National Academy of Sciences[1] to be unreliable. Here by using Experimental engineering, we will design, calibrate and implement a polygraph test. Here, we will be able to sample data which is being obtained from two different sensors collecting two different types of data.

The first and fore-most sensor is called as skin sensor or galvanic skin sensor, which can be able to calculate the rate of perspiration of the subject's hand.

The latter sensor iselectrocardiogram (ECG), which computes movement of the person who is being tested by Lie detector. After this detector is assembled and interfaced, at starting, we will gather data from some of the volunteers. Their movements and perspiration data will be documented while they will be asked a series of sets of test questions.

Afterwards they will be asked whether the questions are being answered correctly or not. In other words, which questions are being answered wrong by them.Basing upon the data provided by them, we will mark the data and computeswhatpercentage of change is present in his words, which we called as lie. From these pre-determined values, the LABVIEW software will be interfaced which will be able to gather readings in future, from persons who acts as subjects and will be compared these new values to the pre-marked data.

If the readings which are obtained from the subject, are above our pre-determined level, the LABVIEW software will be activated and abuzzer or buzzer system will be provided which is used for indicating that the subject is telling a lie.

NI MyDAQ - Brief introduction:

This NI MyDAQ will be available in considerable price. The main purpose of using this DAQ is for Data Acquisition purpose. It uses software called Lab VIEW. This DAQ allows the students to analyze and measure the properties of real world signals. With the combination of LabVIEW on the PC and DAQ, students can be able to process and analyze the acquired signals and be able to control certain simple processes anywhere, anytime.

II. LITERATURE REVIEW:

The study of physiological methods for lie detection tests measuring disturbances of emotions started in the 1900s. Benussi, the first person to work on practical Lie detection tests which are based on physiological changes. He detectsthe changes in expiration and inspiration ratio-findings which are conformed by N.E. Burtt. Burtt conducted several studies that tell the changes in systolic and diastolic blood-pressure, quantitatively. William Moulton Marston[2] studied blood-pressure and recorded that the increase in level of systolic blood pressure is nearly of 10 mm Hg(Mercury) or over indicated guilt by using the tycos sphygmomanometer[3], with which he reported that his results with 90-100% accuracy. His research work and studies are being used by actual court cases and thestudents. Systolic blood-pressure by oscillatory movements determined by W.M. Marstonin 1913, and his results cited that the accurate changes in blood pressure during the Lie deception of criminal suspects will helps us for finding the deception percentage. In 1921, Larson founded the fault that Marston's intermittent B.P. method because emotional changes could be used and there may also be certain persons who could be lost. To correct

his experiment, he modified the Erlanger sphygmograph for giving a continuous B.P. and pulse curve and it was used to detect 4,000 criminals.

III. SYSTEM ARCHITECTURE:

This Lie detection system architecture consists of mainly two units one is NI MyDAQ and other one is basic circuitry [4].

There are 3 main approaches for this polygraph test:

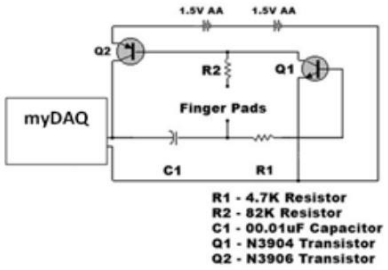
3.1 The Control Question Test (CQT): This test will compare the results of physiological outputs to appropriate questions about the crime with the response to questions. "This test is very frequentlyused to determine whether certain criminals should be prosecuted or to declare that the personhas involved in the crime or not." (American Psychological Association)[5].

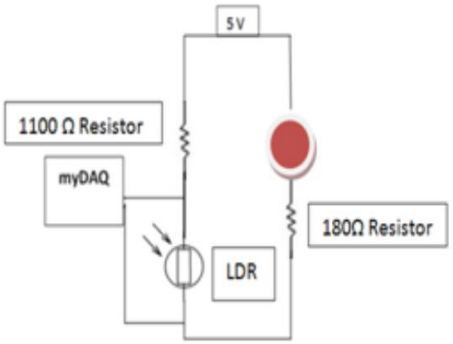
2. **3.2The Directed Lie Test (DLT)**. This test tries to detect lies by comparing the results of physiological outputs when the person is told to carefully tell the lie to results when they are telling the truth.

2. **3.3The Guilty Knowledge Test (GKT)**. This test will compares the results of physiological outputs to MCQ (multiple-choice type questions) about the crime, one choice of which has data or information only the criminal and the crime investigators would know about it.

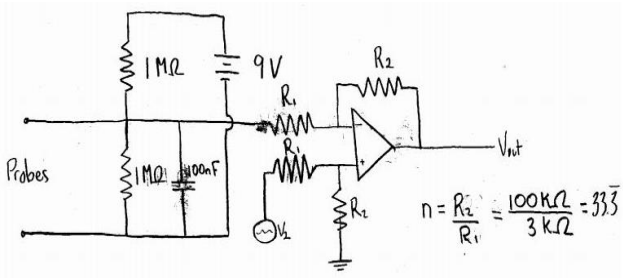
IV. PROPOSED CIRCUIT MODELS:

4.1Basic Circuit:





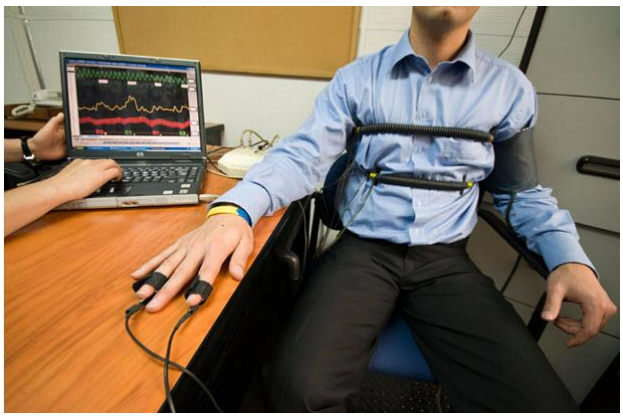
4.2 Lie Detector Circuit (With skin Resistance):



4.3General Lie Detector Illustration:

The most commonly using Lie detectorequipment in airports is Skin-flush lie detection. This is used to track the blood flow in the body and face using thermal cameras.Aberystwyth

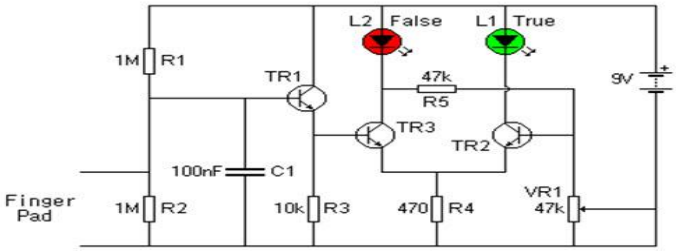
University and Bradford University [6] developed this lie detector system architecture. This lie detecting system had secured the huge amount of publicity in Britain. A fully designed lie detector called the Embodied Avatar Kiosk is using for testing purpose at US border posts from past 20 years. The ATM-sized kiosk [7], which was developed by a consortium, led by the University of Arizona, interviewsthe travelers Max Headroom style. Infrared (IR) cameras, microphones, touch screens and standard cameras, analyze the outputs or responses and alert the border security personnel to suspect the person who is lying.



Lie Detector Illustration

V.MODE OF OPERATION

The circuit diagram(schematic) of the Lie Detector is shown in below figure. This entire system consists of three(3)transistors TR3, TR2 and TR1, two(2) LED lights L2 & L1, five(5) resistors R1, R2, R3, R4 & R5, a capacitor C, and a variable resistor VR1. A small NPN transistor alone withBC549, BC548 and BC547transistors were also used.



5.1 Lie Detector Circuit:

Depending on the differences in the person's skin resistance, that is, if they sweat, it means that, those persons were lying. This is how, the Lie Detectioncircuitryactually works. Let us consider the circuit in which the Resistors R1 and R2 which forms a voltage divider, and it contains resistances of 1,000,000 ohms (1 mega ohms). These values will be equal as the battery voltage is double the voltage at upper probe i.e., nearly 4.5 volts. Two Transistors (TR1 and TR2) act as the voltage comparator circuit. If the voltage at the base of TR3 is lower than at the base of TR2 then the L1(green LED) will turns ON. If the reverse is true then the L2(red LED) will be turned ON.

Capacitor C1 works in a fine way and it discards the 60Hz mains induced frequency which is noticed from the body of person. R3 and TR1 forms a voltage buffer circuit which is called anCommon collector Amplifier (emitter-follower). The voltage at the TR1Emitter, follows the voltage which occurs at the wire of the probe. This will be enough to drive TR2 transistor.

The resistance of skin which is dry, has about 1 Megaohm and the resistance of skin which is in moist will be reduced by ten factor [8] or even it may be more.For testingthis, Lie Detector, you should hold the wire of probe ends and now VR1 is adjusted till the L1(green LED) is tuned ON and the L2(red LED) is turned OFF. At this stage, the voltage at TR3 base will be less than that of TR2 base. Later to carry the probes, we need to use moist fingers. This decreases the skin resistance and makes the TR2 voltage to drop to the considerable levels. The TR3 basevoltage is more and the L2(red LED) will be turned ON. The voltage at the upper probe wire will be changed depending on the actual skin resistance.

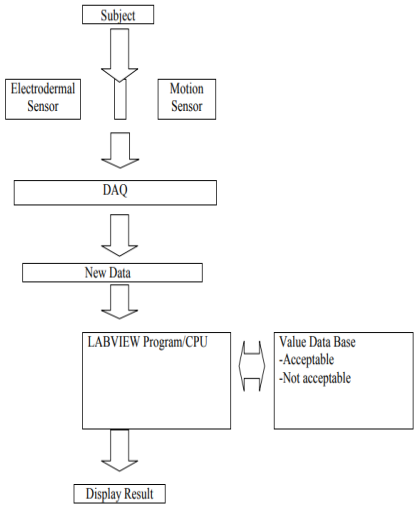
5.2 Usage of the Lie Detector circuitry:

The Lie Detector circuitry requires certain adjustments before it is going to be used. This detector needs some adjustments for change of every person, because the nature of the skin resistance varies from person to person, by nature.By touching the wires of two probes against the palm of hand which is dry, the metal ends are should not to touch each other. Tune the control VR1 till the L2-red light (FALSE) turns OFF. Now the Lie Detector is arranged for person's skin resistance type. If hesenses the wires against the palm, the red light (L2) will be turned ON. We need to know how the Lie Detector circuitry is useful to identify real lie telling person or lying person.

Working of Actual Lie Detector circuitry

For knowing the lie, we need to touch the wires of two probes against the palm and we should adjust the tuning control just before red light turns out. If a person starts sayinglies, he starts to sweat then the red light will be able to show brighter light. In general Lie Detector circuitry does not detect every lie from all the persons because it detects only when the personis feeling nervous as well as sweating. When the person starts pretending, then the detector doesn't show any effect on the result.

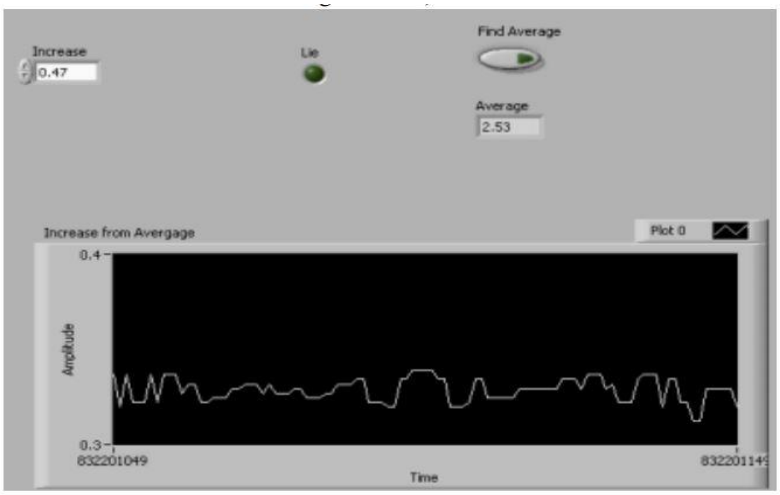
VI. Project Block Diagram:



VII. Data and Results:

7.1 Galvanic Skin Response:

Belowgraph represents the output results of skin sensor(galvanic skin response sensor). As shown below, the subject or person was not telling any lies because he/she was not crossing the pre-determined threshold limit. If the curve crosses 0.47 V, which is the threshold limit,then a lie would be indicated at the output response.

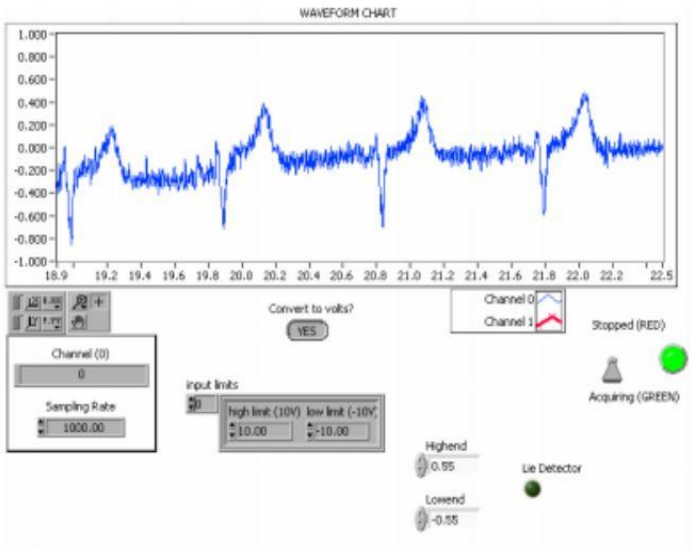


7.2 EKG:

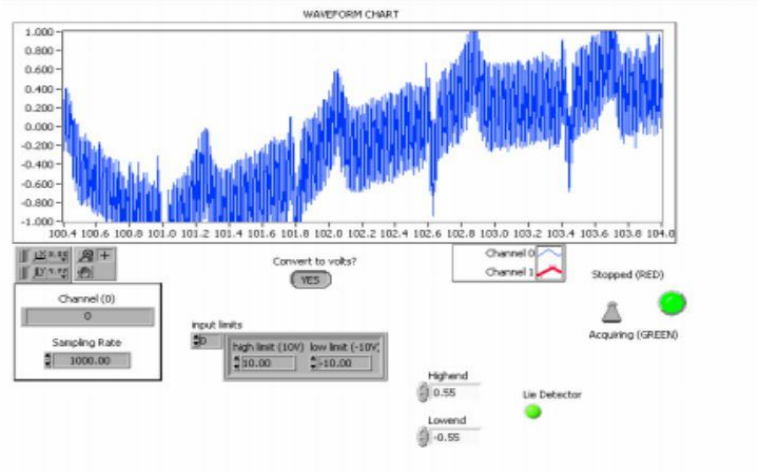
- Here, Electrical impulses generated by a human heart will be displayed.
- Whenever some voltage level is generated by the heartwhich rises higher than the pre-determined value which is indicating irregular behavior.
- Movements from bodily extremities, specifically the arms and legs would be detected.

OUTPUT WAVEFORMS:

7.3 Normal EKG Waveform:



7.4 DECEPTIVE WAVEFORM:



7.5 SOURCES OF ERROR:

- Test subjectNervousness.
- Calibration errors.

7.6 Difficulties: Mainly the major difficulties are:

- Lab Setup.
- Galvanic Skin Response.
- Heart Rate Monitor.
- LABVIEW.

VIII. CONCLUSION

Although the lie detector circuitryis not in a position to determine whether the personis actually lying or not. This project helps in learning a great things about experimental engineering, circuitry, and electronic devices. First of all, we learned how complex the simple electronic devices could be and useful to obtain the results accurately. Blood pressure and Heart rate seems so easy to determine. Yet, by adding the extra circuit has been increased the complexity of having to measure each in real time, we discovered that they are not as simple as they seemed to be as in the form of circuit. Second, we acquired the knowledge about how to question our equipment before to start building an experiment. We gained the knowledge with much delay that, our NI MyDAQ did not have a suitable sampling rate which is essential to work with galvanic skin response sensor. Also, we came to knew that it is very difficult to measure the heart rate continuously to obtain accurate and exact output results from the LABVIEW software or program before starting the project. Finally, this project taught us to keep trying at what time things go wrong. We were in a position to incorporate two sensors which are used to obtain bodily responsesinto our analysis, which was actually enoughto determine the lying content whenever a person had increased stress levels.

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