

# Lie Detector: Measure Physiological Values

Nidhi Srivastava and Dr. Sipi Dubey

RCET, Bhilai,

**Abstract—** The lie detector known as Polygraphic Recorder, since it records physiological changes of a subject under test. Various changes in parameters such as respiration rate, blood pressure (B.P) are used to interpret the percentage of lying by the subject. It is possible to analyze and display the possibility of lying by a subject reliably using expert system. The purpose of this study is to investigate the physiological responses while the subject is lying. When we lie, our blood pressure goes up, our heart beats faster, we breathe more quickly (and our breathing slows once the lie has been told). This work evaluating, examining, calculating and observing, an examiner can tell from those scribbles whether or not you have spoken the truth.

**Index Terms—**Polygraphic recorder, lie detector, BP

## I. INTRODUCTION

We have already published the paper. [1]The Polygraph, known as a lie-detector is used for the recording of changes in the physiological phenomenon such as heart rate, blood pressure, pulse rate and respiration rate which are under involuntary control of a human subject when interrogated. The recorded changes in these parameters are analyzed and correlated in respect to specific questions. The experts in the area can find out how much a subject is lying. There are detection associated with a guilty conscience, allows for the detection of lying. The fear in mind can activate a nervous system response which results in several involuntary physiological changes in the individuals. An attempt has been made to develop an expert system considering the changes in the physiological parameters as inputs, using appropriate weightings to the parameters to detect how much a subject is lying [2]. The project was formed to develop and administer experimental studies to:

Explain and apply the regulations established by the Polygraph.

Implement the procedures that must be followed when administering a polygraph test.

Understand and observe throughout the testing process and create a hand-held portable lie detector.

In addition, studies were excluded because their primary focus was on a theoretical factor thought to affect validity, such as

variability in physiological recordings, nonstandard means of interpreting such recordings, or the role of “lying”.

Such studies will be referred to as laboratory investigations and are distinguished from analog studies. This form of the polygraph examination represents an alternative proposed for use in the field, even though it has not been put into general practice [3].

## II. LITERATURE REVIEW

Lie detection is a consistently controversial topic, how can a machine tell truth from deception? Does everyone have the same physiological reaction when telling a lie? There are many reasons why someone’s blood pressure, breathing, heartbeat and perspiration rate might increase in response to a question; it is speculative to presume that guilt is the primary trigger. They might be embarrassed or angry, or fearful about being incorrectly accused [4]. The polygraph was invented in 1921 by John Augustus Larson, a medical student at the University of California at Berkeley and a police officer of the Berkeley Police Department in Berkeley, California. According to Encyclopædia Britannica, the polygraph was on its 2003 list of the 325 greatest inventions [5].

Polygraphy is widely rejected by the scientific community because they consider it to be pseudoscience [6]. Nonetheless, polygraphs are in some countries used as an interrogation tool with criminal suspects or candidates for sensitive public or private sector employment. US federal government agencies such as the FBI and the CIA and many police departments such as the LAPD use polygraph examinations to interrogate suspects and screen new employees. Within the US federal government, a polygraph examination is also referred to as a psychophysiological detection of deception (PDD) examination.

Recent research reveals that the accuracy of the new computerized polygraph system is close to 100 percent. In the past 75 years, over 250 studies have been conducted on the validity, accuracy and reliability of polygraph testing (American Polygraph Association 1996 Polygraph Issues & Answers). Based on twelve separate studies involving 2174 real cases since 1980, evidence suggests that qualified field polygraph examiners are 98 percent accurate in their overall decisions [7]. Research clearly indicates that when administered by a competent polygraph examiner, the polygraph test is the most accurate means available to determine truth and deception.

### III. METHODOLOGIES

Here is a simple Lie Detector that can be built in a few minutes, but can be incredibly useful when we want to know if someone is really telling the truth. It is not as sophisticated as the ones the professionals use, but it works.

#### A. Implementation

The system is built from three different devices and a human connectivity tester. All the devices are packed into a package which is portable and easily managerial. The electrodes can be alligator clips (although they can be painful), electrode pads (like the type they use in the hospital), or just wires and tape.

Figure 2. Galvanic skin resistance schematic diagram

wire and is now able to drive transistor TR2. Transistors TR1 and TR2 act as a voltage comparator. If the voltage at the base of TR2 is higher than at the base of TR3 then the green LED (L1) will come on. If the reverse is true then the red LED (L2) will light up. To test the Lie Detector v1.0 hold the probe wires. Adjust VR1 until the green LED is just on and the red LED is just off. This is the point at which the voltage at the base of TR2 is just greater than at the base of TR3. Now use moist fingers to hold the probes. This lowers the skin resistance and causes the voltage at the base of TR2 to fall. The voltage at the base of TR3 is now greater and the red LED comes on.

To use the device it, attach the electrodes to the back of the subject's hand, about 1 inch apart. Then, adjust the meter for a reading of 0 milliAmpere. Ask the questions. You know the subject is lying when the meter changes.

The device of the Lie Detector v1.0 is shown above (Fig. 2). It consists of three transistors (TR1 to TR3), a capacitor (C1), two lights or LEDs (L1 & L2), five resistors (R1 to R5), and a variable resistor (VR1). This device is based on the fact that a person's skin resistance changes when they sweat (sweating because they're lying). Dry skin has a resistance of about 1 million ohms, whereas the resistance of moist skin is reduced by a factor of ten or more. Resistors R1 and R2 form a voltage divider. They have resistances of 1 Mega ohms and, because their values are equal, the voltage at the upper probe wire is half the battery voltage (about 4.5 V).

A person holding the probe wires will change the voltage at the upper probe wire depending on their skin resistance. The skin resistance is in parallel with R2 and, because it is likely to be similar to or smaller than R2, the voltage at the probe wire will fall as skin resistance falls. Capacitor C1 functions as a smoothing capacitor and removes the 50Hz induced mains hum that is found on a person's body. TR1 and R3 form a buffer device (called an emitter-follower). The voltage at the emitter of TR1 follows the voltage at the probe. When a person lies, nervous system will react excited and more sweat will be secreted from skin.

Hence, it increases the conductivity of the skin and completes the device. Speaker will alarm and the person is determined as a liar.

#### B. Software Implementation

Software is implemented in this hardware to enhance the process of the screening and reduce the paper work and time consumed for the whole experiment. The language used in this project is Microsoft Visual C++ 6.0 Professional Edition Service Pack 6. It is the most productive C++ tool for the highest-performance development for Windows. Matlab software is used to build a Voice Analyzer to analyze voice's amplitude and pitch.

#### C. Screening Process

A polygraph exam is a long process that can be divided up into several stages. Here's how a typical exam might work:

**Pretest** - This consists of an interview between the examiner and examinee, where the two individuals get to learn about each other. This may last about one hour. At this point, the examiner gets the examinee's side of the story concerning the events under investigation. While the subject is sitting there answering questions, the examiner also profiles the examinee. The examiner wants to see how the subject responds to questions and processes information [8].

**Design questions** - The examiner designs questions that are specific to the issue under investigation and reviews these questions with the subject.

**In-test** - The actual exam is given. The examiner asks 10 or 11 questions, only three or four of which are relevant to the issue or crime being investigated. The other questions are. A control question is a very general question, such as "Have you ever stolen anything in your life?" — a type of question that is so broad that almost no one can honestly respond with a "no." If the person answers "no," the examiner can get an idea of the reaction that the examinee demonstrates when being deceptive [9].

**Post-test** - The examiner analyzes the data of physiological responses and makes a determination regarding whether the person has been deceptive. If there are significant fluctuations that show up in the results, this may signal that the subject has been deceptive, especially if the person displayed similar responses to a question that was asked repeatedly.

There are times when a polygraph examiner misinterprets a

person's reaction to a particular question. The human factor of a polygraph exam and the subjective nature of the test are two reasons why polygraph exam results are seldom admissible in court [10].

Lie detection uses as a questioning technique with the technology that record physiological functions to ascertain truth. Lie detection try to discriminate lying from truth telling .Changes in body functions are not easily controlled by the conscious mind.

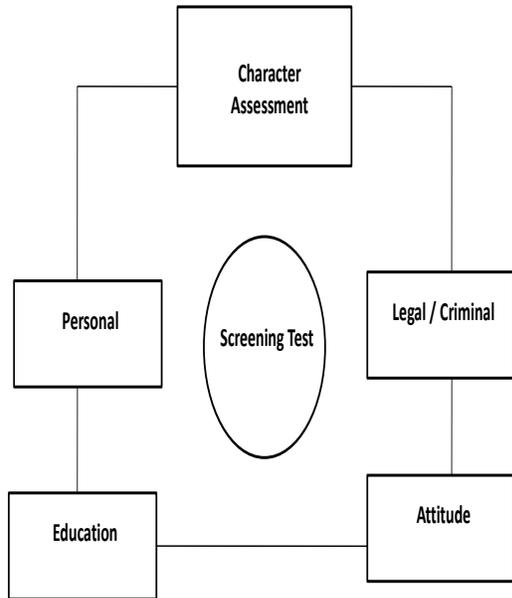


Fig 1. Screening Process Aspects

The question that will present to the subject consist of 5 aspects ( C(character assessment, legal/criminal, attitude, education and personal). All the questions will computerized and randomly selected for each session of screening process.

#### IV. RESULT AND DISCUSSION

| Result  |        |
|---|--------|
| Questions   | Answer |
| 1. Lie to anyone in your Family.                                    | Yes    |
| 2. Have you ever used anyone else's identity to do illegal process. | No     |

Fig 2. Result Interface

Figure above shows the result after some questions are presented to the subject. Examiner Examiner needs are presents to the subject. to evaluate every physical signal that measured by the hardware with his subjective perspective.

Let us compare the result from Q1 and Q2. Readings from hardware for Q1 are low in blood pressure, stable analog meter and LED emits green light while Q1 obtains the opposite results. All this can be concluded that the subject tells a lie for Q1 but he shows his truthfulness in Q2.

It measures and records the several physiological functions like blood pressure, pulse rate and respiration rate when subject is asked the series of questions and give answers.

The belief on the use of the lie detection is that deceptive answers will produce the response of physiological function that can be differentiated from the associated with non-deceptive answers.

Lie detection can measure arousal, which is caused by anxiety disorders like nervousness, confusion, fear and depression etc.

Lie detection typically start with the test sessions with a pre-test interview part to gain some preliminary information which will be used later to develop diagnostic questions. Then the tester or examiner will explain how the lie detection is supposed to work. It emphasize that lie detection can detect lies and it is important to answer truthfully.

**Result**

**Note**

According to the Lie Detector the person is lying. Please read the value to understand what the lie calculator result mean and how to interpret them.

Fig 3. Result

Meanwhile the Lie Calculator test determine a truthfulness of a subject by calculating the probability through his physical signals include eye blinking, head scratching, limbs fidgeting, mouth or face touching, eye contact, tone or pitch changing. Every positive response to the question will contribute.

probability to the calculation. A total of probability is interpreted as the person is lying.

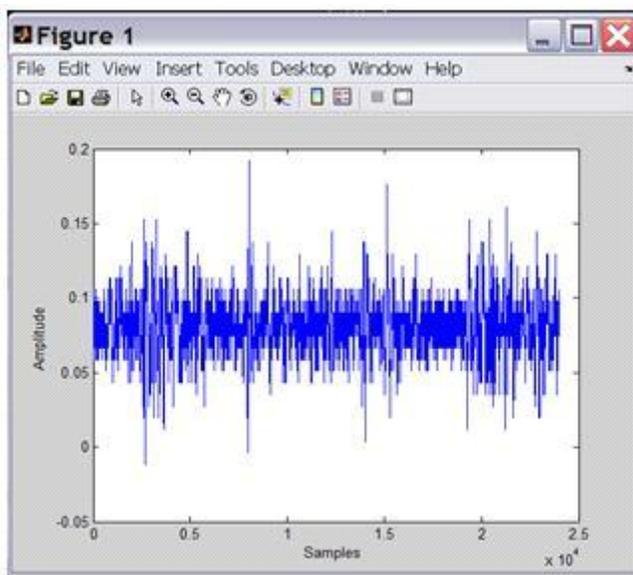


Figure 4. Result interface (Voice)

Voice Analyzer analyzes the subject's tone. When the subject tells a lie, his physical response will change in terms of his voice's amplitude. The more obvious of changes of amplitude, the higher probability of the subject is lying.

### CONCLUSIONS

The best scenario for using the Lie Detector v1.0, Lie Calculator and Voice Analyzer are when the individual being confronted is caught on the wrong foot and does not know that he is about to be asked a certain question for which answer will have to be spontaneous. Under such a scenario, the individual's natural reactions will come into play and prove to be valuable for the hardware and software test. The device still has a few limitations that will fluctuating the readings obtained.

The algorithms need to be refined to maximize sensitivity/specificity, minimize time needed to conduct an evaluation.

### REFERENCES

- [1] Nidhi Srivastava and Dr. Sipi Dubey , August 2014, “ Lie Detection System Using Artificial Neural Network” , JGRCS, Volume 5, No. 8, ISSN – 2229 – 371X .
- [2] G.W. Maschke and G.J. Scalabrini. (2005) The Lie Behind the Lie Detector. 3rd Ed.
- [3] J. J. Furedy. (1993). “The CQT Polygrapher's Dilemma: Logico-Ethical Considerations for Psychophysiological Practitioners and Researchers,” International Journal of Psychophysiology, Vol. 15, pp. 263-67.
- [4] K. Alder. (2007). The Lie Detectors. New York: Free Press.
- [5] “Polygraph/Lie Detector FAQs”. International League of Polygraph Examiners. [http://books.nap.edu/openbook.php?record\\_id=10420&page=292](http://books.nap.edu/openbook.php?record_id=10420&page=292)
- [6] WILLIAM MOULTON MARSTON, THE NATIONAL RESEARCH COUNCIL, AND WONDER WOMAN. [http://www.theilpe.com/faq\\_eng.html](http://www.theilpe.com/faq_eng.html)
- [7] A. Norman. (1990). “The validity and reliability of polygraph decisions in real cases”, Polygraph, v.19.
- [8]. C. J. Patrick and W.G. Iacono. (1991). Validity of the control question polygraph test: the problem of sampling bias, J Appl Psychol 76, pp. 229–238.
- [9]. Ross and Richard (2005). “Investigation Continues: Security Breach at the White House”. ABC News.”
- [10]. N. J. Roes. (1993). “Twenty years of bogus pipeline research: A critical review and meta-analysis”. Psychological Bulletin 114: 363–375.
- [11]. S. Blinkhorn. (1988) “Lie Detection as a psychometric procedure” In “The Polygraph Test” 29-39.