COMBATING FEMALE FOETICIDE:

AN IMPLEMENT OF WAR

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ABSTRACT

Medical imaging is the technique and process of creating visual representations of the interior of a body for clinical analysis and medical intervention, as well as visual representation of the function of some organs or tissues. Obstetric ultrasonography is the use of medical ultrasonography in pregnancy, in which sound waves are used to create real-time visual images of the developing embryo or foetus in its mother's uterus (womb). We propose the use of machine intelligence to quickly acquire the data related to the health, development and sex of the foetus. The data is encrypted and stored as a portable electronic health record in an online data base. The machine intelligence and the data portability of the data base ensure high degree of control in record keeping and accessibility. The scanning system and the scanner

Keywords: Medical imaging, data encryption security, Artificial intelligence, Ultrasonography, 3D reconstruction

INTRODUCTION

Sex-selective abortion is the practice of terminating a pregnancy based upon the predicted sex of the infant. The selective abortion of female foetuses is most common in areas where cultural norms value male children over female children, especially in parts of East Asia and South Asia (particularly in countries such as People's Republic of China, India and Pakistan), as well. Reports focusing on sex-selective abortion are predominantly statistical; they assume that birth sex ratio - the overall ratio of boys and girls at birth for a regional population, is an indicator of sex-selective abortion. This assumption has been questioned by some scholars. The decline in child sex ratio in India is evident by comparing the census figures. In 1991, the figure was 947 girls to 1000 boys. Ten years later it had fallen to 927 girls for 1000 boys. Since 1991, 80% of districts in India have recorded a declining sex ratio with the state of Punjab being the worst. States like Maharashtra, Gujarat, Punjab, Himachal Pradesh and Haryana have recorded a more than 50 point decline in the child sex ratio in this period. Despite these horrific numbers, foetal sex determination and sex selective abortion by unethical medical professionals has today grown into a INR 1,000 crore industry (US$ 244 million). Social discrimination against women, already entrenched in Indian society, has been spurred on by technological developments that today allow mobile sex selection clinics to drive into almost any village or neighbourhood unchecked. The PCPNDT Act 1994 (Preconception and Prenatal Diagnostic Techniques Act) was modified in 2003 to target the medical profession - the ‘supply side’ of the practice of sex selection. However non implementation of the Act has been the biggest failing of the campaign against sex selection. According to the latest data available till May

2006, as many as 22 out of 35 states in India had not reported a single case of violation of the act since it came into force. Delhi reported the largest number of violations – 76 out of which 69 were cases of non-registration of birth! Punjab had 67 cases and Gujarat 57 cases. In this regard, we propose a digital solution for the problem.

THE PROPOSED SOLUTION

The proposed solution is to link the electronic health record with the Aadhaar. Whenever a person has to undergo scanning process the scanning system should demand the Aadhaar of the person undergoing the scan and should not scan them if they fail to produce the Aadhaar at the time of scan. The QR code on the document provides easy identification. The scanner when scanned automatically retrieves the biomedical data and uploads it to the data base, maintained by a government organization, to the profile of the patient. At the time of the delivery of the baby, the hospital can access the data from the data base and the sex of the baby determined at the scan and the baby delivered should match. Any irregularities can be questionable and the involved be punished.

THE ULTRASOUND SCANNER

An ultrasound scanner works by sending high frequency sound pulses into a patient's body. The sound waves travel through the patient's body, passing through different types of tissue. Although the average speed of sound through human tissues is 1540m/s it does vary with exact tissue type. While the speed of sound through fat is1459 m/s, it passes through bone at 4080m/s. Whenever sound encounters two adjacent tissue types with different acoustic properties a proportion of the sound energy is reflected. These boundaries between different tissue types are called acoustic interfaces. The amount of sound reflected back from an acoustic interface depends on a property of the materials on either side of the interface called acoustic impedance. The acoustic impedance of a material is simply its density multiplied by the speed at which sound travels through it. The scanner calculates the distance from the probe to the acoustic interfaces based on the time taken for echoes to bounce back to the probe. The distances and intensities are then displayed on a screen to form a two dimensional image. Some modern machines are now capable of producing three dimensional (3D) images. This can be done by using a conventional scanner and imaging software which compiles the original 2D images into a 3D representation. The resulting 3D images are very useful for planning surgical procedures etc. Alternatively, a more complex machine can be used with multiple scanners, allowing the creation of real time 3Dimages.

THE PARTS OF AN ULTRASOUND SCANNER

A typical ultrasound scanner consists of these parts:

- The transducer probe is the part of the machine that produces the sound waves and receives the echoes. It consists of one or more crystals in a plastic housing. A high frequency potential difference is applied across the crystals causing them to change shape very rapidly – this is the piezoelectric effect, hence the crystals are called piezoelectric (PZ) crystals. This generates the necessary high frequency sound waves. The sound waves are then focused by an acoustic lens. When sound waves bounce back to the probe they cause the crystals to change shape and this generates a potential difference which can be measured. This signal is then processed to form the ultrasound image. Because the same piezoelectric crystals are used for sending and receiving the ultrasound pulses they have to operate in a switched or pulsed mode. This means that they emit a quick sound pulse, rest and then listen for the echo. This switching between transmitting and receiving modes happens many thousands of times a second.
- The transducer pulse controls allow the ultra sonographer operating the machine to alter the frequency and length of the ultrasound pulses to suit any given conditions.
- The central processing unit (CPU) is a computer. It sends the electrical signals to the transducer probe and receives signals back from it. The CPU carries out all of the data processing necessary to create the final image.
- The display is usually a high definition computer monitor. Ultrasound images are displayed using a grey scale. High amplitude echoes are received from areas where there is a high acoustic mismatch and these are displayed as light grey or white pixels. Echoes received from areas where there is a small acoustic mismatch are displayed as dark grey. Black pixels represent a lack of echoes.
- The keyboard and cursor allow user to add notes to the images as they are displayed.
- Disc storage allows scans to be stored digitally and kept with a patient's medical records.
- A printer is usually attached to the machine so that hard copies of images can be printed off as required.

USE OF ARTIFICIAL INTELLIGENCE

Efficient medical imaging and image analysis can be achieved using computational methods and algorithms to analyse and quantify biomedical data. The information analysis and visualization techniques used in

biomedical research can be used here too. Various applications and methodological software available give the ability to analyse biomedical data to help in the discovery of medical knowledge and the diagnosis of many diseases. The same can be utilized as machine intelligence in the scanning machine which automatically analyses the scan specimen of its various characteristics and upload it on the cloud storage.

DATA ENCRYPTION

The data acquired from the 3d reconstructed images are to be encrypted before uploading to the data base, transferring of data or when retrieved back. Encryption is used to protect the confidential biomedical digital data which is stored in the computer data base system. The data is confidential with the interest of the patients. The encrypted data comprises of mother's Aadhaar details and other biological information of the foetus and the parent. The data encrypted is accessible only to specific people which includes police during investigation and higher loyal officials. The encryption ensures the privacy of the patient. The process generates cipher text that can only be viewed in its original form if decrypted with the correct key. Encryption in simple words is translating the actual data into a secret code.

ADVANTAGES

- With the implementation of such a system nation's sex ration be monitored.
- Provides a digital proof of the crime incidents.
- Gives teeth to the concerned officials to act on the crime.
- Citizen's health record can be maintained electronically.
- The health data is portable. That is, it can be accessible from another facility when in need.
- A smart and efficient way to monitor and to have an account of the birth rates.
- With the implementation of the system the birth certificates can't be faked.
- Uses Aadhaar to refer to a particular person.

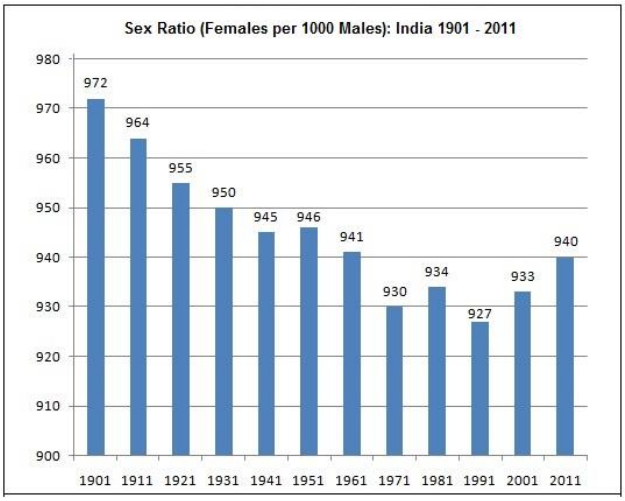
DISADVANTAGES

- Not all the time the scanning process determines the sex of the foetus.
- Entire nation should upgrade the system. This means that all the government, private hospitals and scanner centres should upgrade.
- The scanner may not be cost effective, perhaps expensive.

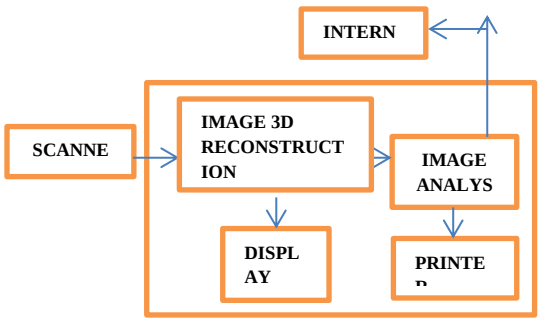
MAKE IN INDIA APPROACH - CONCLUSION

Indian population has shown a drastic rise through years, of which the girl child mortality rate has taken an exponential hike. On this perspective, there is an alarming requirement to take a strict action towards this situation. On this motive of make in India a new scanner and the scanning system is proposed in this approach. This concept may at least bring a positive transition saving girl children. If the system is implemented on our legitimate view point it will revolutionize India and the globe. The system connects the hospitals in the country and serves as an implementation of the war against female foeticide. The challenging advancement in modern technology has left the young minds in an era to give the solution to the current problem and this is done with the proposed scanner and the scanning system.

SUPPORTING DIAGRAMS



Graph shows the sex ratio in India from 1901 to 2011



Self-explaining block diagram of the scanning system

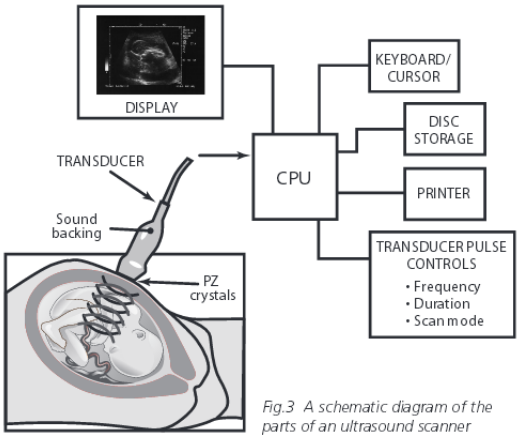


Fig.3 A schematic diagram of the parts of an ultrasound scanner

The scanner

Scanned Foetus

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