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Research Article

An Intelligent System For ToddlerCry Detection

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ABSTRACT

nowadays, it is inconvenient for house keeper parents to constantly watch over their neonate while doing their work. Here we have proposed a simple voice recognition system which can be applied practically for designing a device with capability to detect a baby cry and informing the parents automatically here we are taking input as a sound of the baby and by using that sound we can able to understand what is the specific reason behind baby cry

Keywords: Infant crying, arduino uno, microcontroller

1. Introduction

About 130 million babies are born globally each year. Taking good care of newborns is a big challenge, especially for first time origin. The suggestions from other parents and books is not enough to solve the problems in real time. The main reason is because it is difficult to understand the meaning of the toddler cries. Toddler communicate through the world by crying. Experienced parents, doctors, and nurses understand the weep based on their experiences. Young parents get irritated and have trouble soothe down their babies because all cry signals sound the same to them. Accurately interpreting toddler cry sound can help parents take better care of their babies. Research on infant cry started as early as 1960s when Wasz–Hockert research group identified the four types of the cries (pain, hunger, birth, and uncomfortable) auditory by trained nurses. In the early times, researches have determined that different types of cries can be differentiated auditory by trained adult listeners. But training human perception for infant cry is much harder than training machine learning models. In Mukhopadhyay's study, the highest classification accuracy by training a group of people to recognize some cry sounds is 33.09% while machine learning algorithm based on spectral and prosodic features can recognize the same set of data and reach 80.56% accuracy [2]. Building smart machines to understand infant cry leads the way to build intelligent robot caregivers in the future. Besides understanding toddler daily life needs, disease prediction is another critical task in infant cry research. Since infants' vocal tract and breathing system are affected by some diseases, the cry signals of unhealthy infants contain unique characteristics that differ from healthy cry signals. Known examples of such diseases include deaf, autism, and asphyxia, etc. Analyzing pathological cry signals to identify diseases is a non-invasive and fast method that can save infants' lives, especially in the areas that lack of medical equipment and expertise. In the early years of infant cry research, many works have focused on classifying normal and pathological cry signals. In Saraswathy's review [3], 34 papers on classification of normal and pathological cry signals published from 2003 to 2011 are listed. The works include identifying diseases such as hypo-acoustic, asphyxia, hypothyroidism, hyperbilirubinemia, cleft palate, etc.

Building smart machines to understand infant cry leads the way to build intelligent robot caregivers in the future. Besides understanding infants' daily life needs, disease prediction is another critical task in infant cry research. Since infants' vocal tract and breathing system are affected by some diseases, the cry signals of unhealthy infants contain unique characteristics that differ from healthy cry signals.

2. Motivation

Main motto of the project is to design a kit that helps us in finding out why baby was crying at any situation in any time. In this project we are going to detect some of the important cries like hungry, uncomfortable, painful, not feeling well. For every cry there will be a different sound and here we are using that sound difference like when a baby is crying for hungry it makes some sound it is different from other cries like painful or not feeling well. One more

important cry is when baby is uncomfortable it mainly happens because of wetness of diaper so, we will add a wet sensor in it which detect the wetness.

Existing system

A broad range of literatures are reviewed mainly from the aspects of data acquisition, cross domain signal processing techniques, and machine learning classification methods. We introduce pre-processing approaches and describe a diversity of features such as MFCC, spectrogram, and fundamental frequency, etc. Both acoustic features and prosodic features extracted from different domains can discriminate frame-based signals from one another and can be used to train machine learning classifiers. Together with traditional machine learning classifiers such as KNN, SVM, and GMM, newly developed neural network architectures such as CNN and RNN are applied in infant cry research. We present some significant experimental results on pathological cry identification, cry reason classification, and cry sound detection with some typical databases. This survey systematically studies the previous research in all relevant areas of infant cry and provides an insight on the current cutting edge works in infant cry signal analysis and classification. We also propose future research directions in data processing, feature extraction, and neural network classification fields to better understand, interpret, and process infant cry signals. Here they are using the mobile app called "stable sensor" for detection.

Here they are using the mobile app called "stable sensor" for detecting whether a baby is crying or not. The sensor tile box records sounds and it will send to machine learning algorithm on the host if the system determines that a child is crying. The led on the sensor board turns green and smart phone receives a signal via Bluetooth.

Disadvantages

- ❖ App is working efficiently on iPhone but not on android.
- ❖ Here it will only detect when a baby was crying it doesn't specify any reason behind the cry.12
- ❖ For using this app, person should able to know how to use a phone and there is a chance of broking and it may be switched off at some time.
- ❖ Cost is very high.

3. Proposed System

In our proposed system, we design a kit that helps us in finding out why baby was crying at any situation in any time. In this project we are going to detect some of the important cries like hungry, uncomfortable, painful, not feeling well. For every cry there will be a different sound and here we are using that sound difference like when a baby is crying for hungry it makes some sound it is different from other cries like painful or not feeling well. One more important cry is when baby is uncomfortable it mainly happens because of wetness of diaper so, we will add a wet sensor in it which detect the wetness. We are mainly focusing on 5 basic types of baby's cry sounds. They are listed below as follows:

❖ **Sleepy Cry**

'OWH' if baby needs sleep, then the baby makes the sound as 'owh'. For that i need to take that sound as reference and I store that sound in a device named as 8 channel voice recognizers. I compare that sound with the reference sound.

❖ **Uncomfortable Cry**

'HEY' If baby feels uncomfortable then the baby makes the sound as 'hey'. For 13 that I need to take that sound as reference and i store that sound in a device named as 8 channel voice recognizers. I compare that sound with the reference sound. If it matches then the output is shown in the LCD display as baby feels uncomfortable.

❖ **Painful Cry**

'EAIR' if baby feels painful then the baby makes the sound as 'eair'. For that I need to take that sound as reference and i store that sound in a device named as 8 channel voice recognizers. I compare that sound with the reference sound. If it matches then the output is shown in the LCD display as baby feels painful.

❖ **Not Feeling Well**

'EH' if baby is not feeling well then, the baby makes the sound as 'eh'. For that I need to take that sound as reference and I store that sound in a device named as 8 channel voice recognizers. I compare that sound with the reference sound. If it matches then the output is shown in the LCD display as baby not feeling well. Apart from these sounds, we have also added a temperature sensor and a wet sensor. The description of it is given below.

❖ **Temperature Sensor**

If baby has high temperature the temperature sensor detects the temperature and sends the output to the display as detect fever.

❖ **Wet Sensor**

If baby has a problem in the diaper means when the diaper is become wet then wet sensor detects the output as baby has some diaper issue.

Advantages

- Here, person knows the exact reason why baby was crying.
- Cost is also low compared to existing one.

Infrastructural Requirements

- It has been developed on Arduino Uno development.
- In Arduino Uno we are using Arduino IDE for writing programs.
- Arduino IDE (Integrated Development Environment) it contains a text editor for writing code.
- Analog circuit design has been tested & verified in simulation environment

Components Used

➢ The following components are used in our projects. They are:

- Sound sensor module
- Voice recording module
- Wet sensor
- Temperature sensor
- Arduino Uno
- Connecting wires
- Lcd display

Voice Recognition Device

Voice Recognition Module is a simple unified control console. This produces a speaker based voice recognition unit.Max 7 voice commands, all these commands are running at the 20 same time. Any sound could be trained as command.

Temperature Sensor

They are devices to measure temperature readings through electrical signals. The sensor is made up of two metals, which generate electrical voltage or resistance once it notices a change in temperature. There are many applications that are not-so-obvious, which use temperature sensors.

Wet Sensor

It measures the volumetric content of water inside the object and gives us the moisture level as output. The module has both digital and analog outputs and a potentiometer to adjust the threshold level.

Arduino

Arduino is used to connect and communicate between the various devices. It contains a set of inputs such as sensors, power supply, switches and outputs that control the various devices such as lighting.

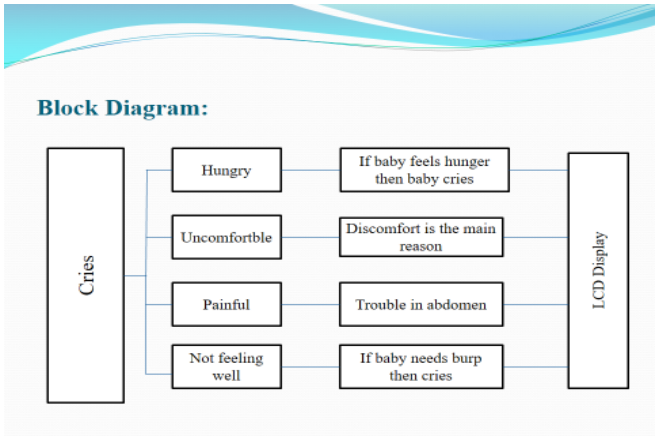

Fig.1: Block diagram

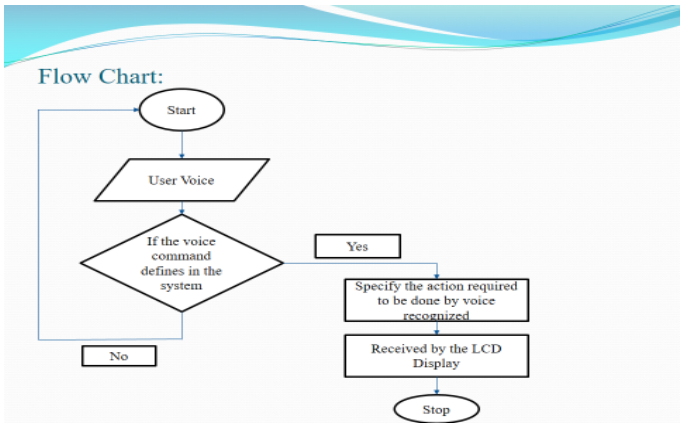

Fig.2: Flow Chart

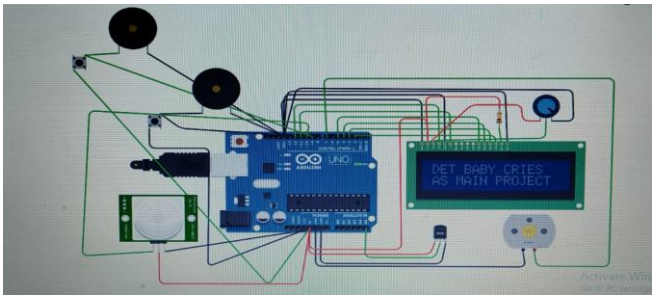

Fig.3: Det baby cry as main project

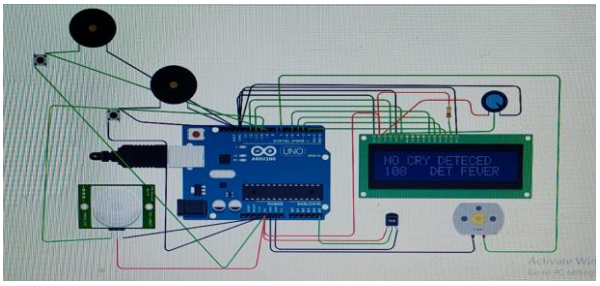

Fig.4: No cry detected no fever detected

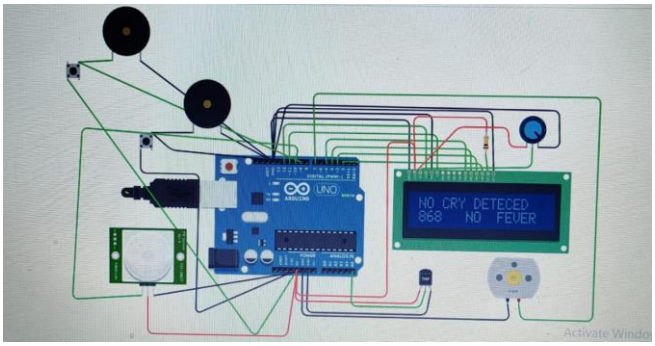

Fig.5:No cry detected fever detected

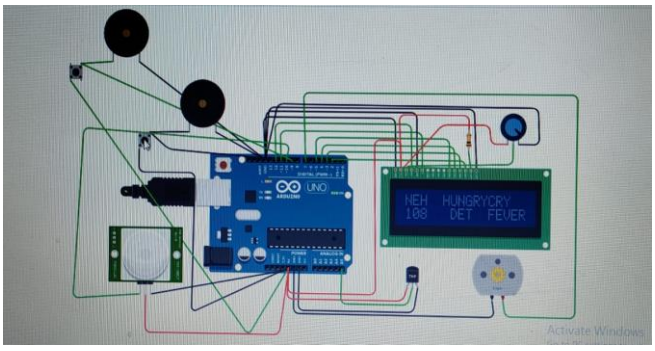

Fig.6: Hungry detected fever

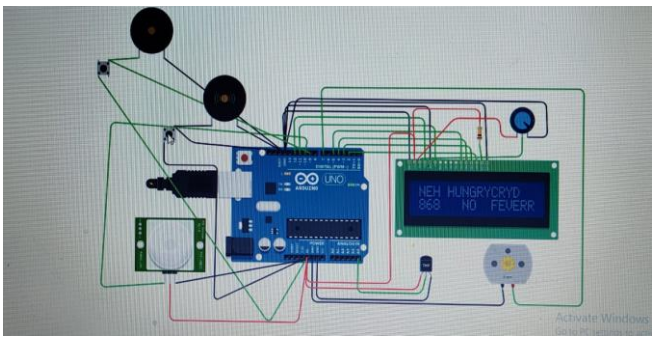

Fig.7: Hungry No Fever

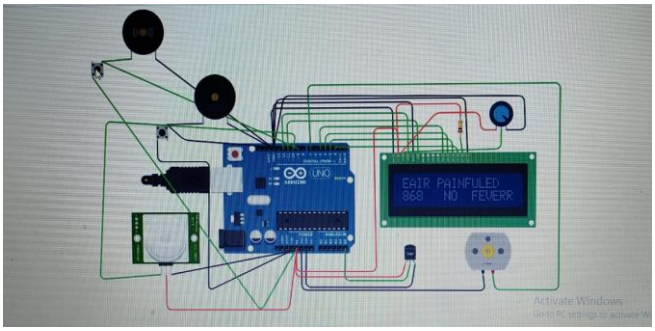

Fig.8: Painful No Fever detected

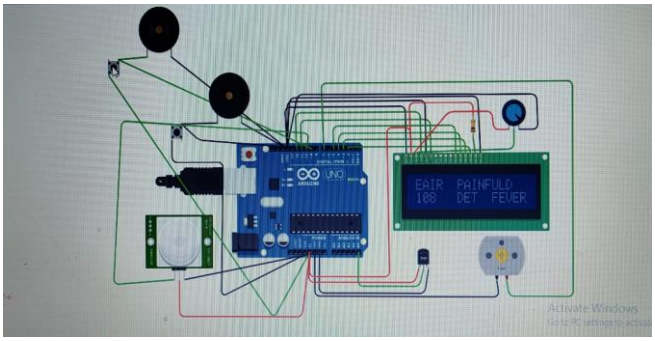

Fig .9: Painful detected fever

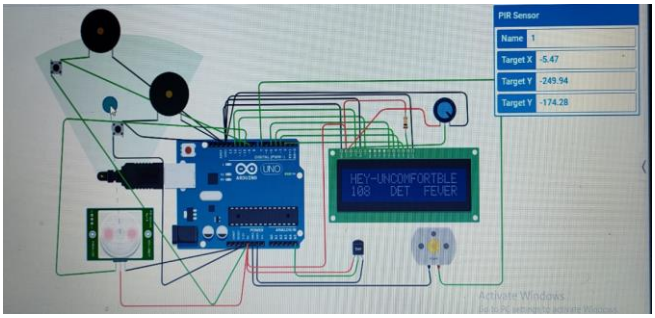

Fig.10: Uncomfortable & detected fever

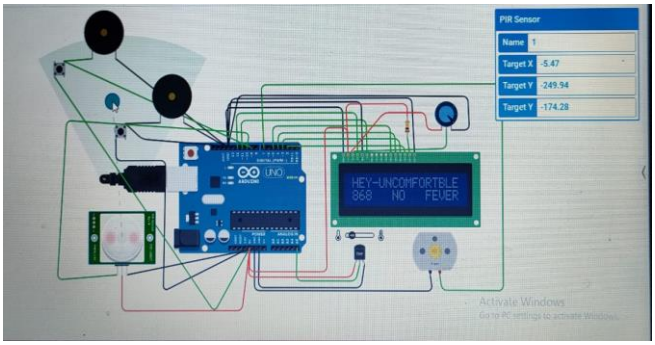

Fig.11: Uncomfortable &No Fever Detected

Conclusion

- An Intelligent Cry Detection Intelligent System (ICDIS) for infant cry monitoring and real time information is developed in this paper. This
- System mainly consists of two parts, Cry detection system and Smart robot. Cry detection system (CDS) captures the real time audio signals and detects the cry signal by applying signal processing methods on the signal. Smart robot can be controlled remotely through the Wi-Fi communication using the ESP8266 (Wi-Fi module) mounted on the robot. This paper also explains how the signal processing is embedded into the microcontroller for identifying the cry

detection. The developed system will record the signals and process them in the signal processing unit.

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