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Infant Care Assistant with Emotion Detection-Using Machine Learning, Image Processing & IOT Sensor Network

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Abstract - *With evolving technology and busy working culture, there is a need of smart device for working parents to help them in monitoring and assisting their child. Infant Care Assistant is such a smart device consisting of IOT Sensor Network, a microcontroller and Raspberry pi to collect information on the current state of the child and its surroundings and soothe it accordingly with automated techniques. Addition to it, an emotion recognition model using machine learning has also been included to detect the face of the child and predict its emotion. Moreover, an app called Blynk has been used for graphical user interface. this model could help reducing workload of busy working parents in taking utmost care of their child.*

Key Words: **Automation, Sensors, Machine Learning, IOT, Infant Care**

1. INTRODUCTION

In the growing era of technology where everything around us is getting advanced and intelligent day by day by the means of artificial intelligence, internet of things and various smart devices such as smartphones, smart TVs, smart watches, smart home appliances and many other devices, then why not a smart assistant??

In this busy world where now a days both the parents are working and have little infants or first-time parents who just entered parenthood and don't have enough experience are facing difficulties in providing sufficient time to the infants provided infants need proper attention and care maximum of the time.so in order to cope with this a solution or a device is need of the time.

A smart assistant is needed to provide proper assistance to the infants in the absence of parents as in monitors the infants all the time, acquire information related to them, send notifications if any attention is required and perform real time interactions between the parents and their child.

2. LITERATURE SURVEY

A Method for Face Segmentation, Facial Feature Extraction and Tracking (Samir K. Bandyopadhyay) [1] presents the comparison between the methodologies used for human face segmentation from face images based on textural analysis and KNN classifier. In Automatic E-Baby Cradle Swing Based on Baby Cry (Misha Goyal and Dilip Kumar) [2] they came up with an initial low-cost E-Baby Cradle that would rock on its own when the baby cries where the speed of the cradle can be regulated. The system consists of an alarm which specify wet mattress of the baby and its loud cry. Baby cry detection in domestic environment using deep learning (Yizhar Lavner, Rami Cohen, Dima Ruinskiy, Hans Ijzerman) [3] includes the use of two machine-learning algorithms for automatic detection of baby cry one is logistic regression classifier & the other is CNN classifier. In Image Processing Techniques to Recognize Facial Emotions (A. Mercy Rani, R. Durgadevi) [4] they proposed an emotion recognition system which included face detection and morphological processing using viola jones algorithm.

3. BLOCK DIAGRAM AND WORKING PRINCIPLE

There are 3 key features of the infant care Assistant i.e., Data acquiring, Infant soothing and emotion recognition. The data acquiring unit consists of IOT Sensor network comprising of various sensors and a node micro controller unit ESP8266 to acquire data related to the child and its surroundings. Here ESP8266 mcu is an open-source software and hardware development environment built on low-cost chip, designed and manufactured by espressif containing its own CPU, ram and wi-fi. This mcu is integrated with various sensors such as a dht11 sensor which is used to detect the humidity and temperature of the infant surroundings, a noise sensor used for detecting infant cry noise, a moisture sensor for detecting the presence of wetness in the child's bed. all the readings of these sensors are then reflected on a freely available android/iOS app called blynk using which parents can monitor their child.

Infant soothing unit comprises of a baby cradle made of metal which would rock by the help of a servo motor and 2 channels relay, when the noise sensor is activated. if the humidity crosses a certain threshold set by the user, the fan would automatically get on. If the moisture sensor senses moisture, then it would reflect on the blynk app saying moisture detected. hence these automated techniques ensure the calming of a troubled child.

The emotion recognition feature includes a raspberry pi module with an attached pi camera. A machine learning code has been developed based on python which on running would trigger the camera to get on and detect the real-time image of the child and predict the emotion whether it is happy or sad or angry or yawning etc. on the window of the terminal.

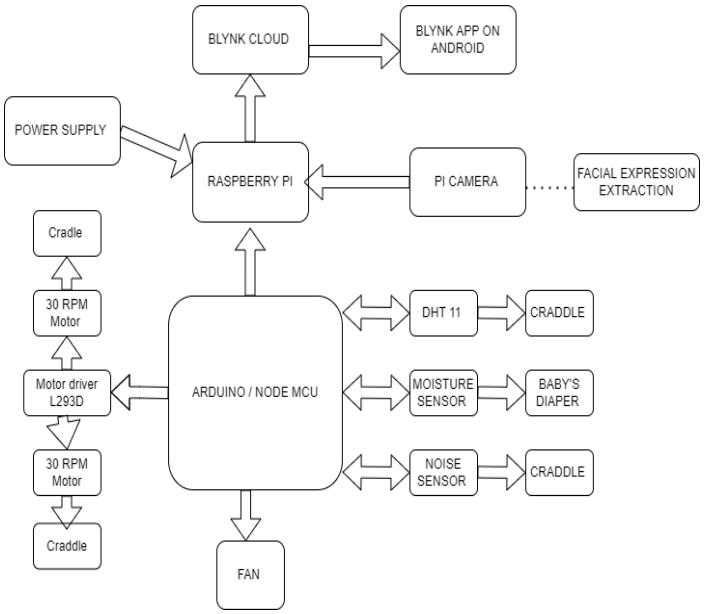

Fig -1: Block diagram of the entire setup.

All these 3 units or features are integrated together as a single set up and power supply is provided to them from a single source and connected to the same wi-fi address.

4. WORKING OF EMOTION RECOGNITION

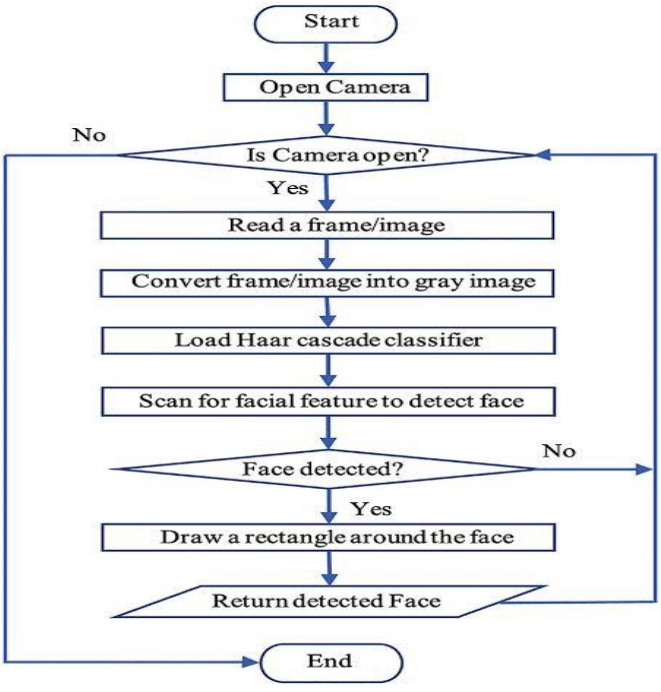

Fig -2: Algorithm of emotion recognition

The flowchart states that when we start or run the code, the camera is triggered to get on. If the camera gets on it would perform further proceedings, if not the algorithm ends. If the camera gets on, it would capture and read the live frame or image.it will then convert the frame or image into gray image internally and load the haar cascade classifier algorithm which is already ready in the code. It is a ML based approach where a cascade function is trained from a lot of +ve and –ve images initially. Later features are extracted from it just like convolutional kernel where a single value is obtained by subtracting sum of pixels of white rectangle from black one.

All possible sizes and kernels are used to calculate features which is around 160000 out of which only relevant features are extracted and compared to the data set and emotion is predicted. Although, there is a scope of misprediction and less accuracy. The classifier scans the frame for facial features in order to detect face. Once detected it would draw a rectangle around the face and if not the steps from 2nd one starts again. If it is done successfully then it returns the detected face with the emotion recognized on the terminal window.

5. ARCHITECTURE

The architecture can be divided into 2 parts i.e., hardware and software.

In the hardware section, the following tools were used:

- Power Supply(12V)
- ESP-32 microcontroller
- DHT11 Sensor
- Moisture Sensor
- Noise Sensor
- Motor and relays
- Fan and Cradle
- Connector
- USB cables & connecting wires
- Raspberry Pi
- Pi Camera

In the Software section, the following tools were used:

- Arduino IDE
- Blynk app
- Library: Blynk, wifi.h
- Board- ESP 8266
- Python libraries-Pandas, CV2, NumPy etc.

6. RESULTS AND DISCUSSIONS

The 3 features implemented in Infant Care Assistant Namely Data acquisition, infant soothing and emotion recognition of the child has been tested. The prototype was able to acquire information of the child and its surroundings and was able to soothe it with the designated automated techniques. the emotion recognition unit was successfully able to detect the child face and predict the emotion out of it. Hence the entire set up proved to be very helpful for the parents in taking care of their child in their absence or during situations like pandemic which required minimal contact.

Fig -3: Cradle developed with attached fan and motor.

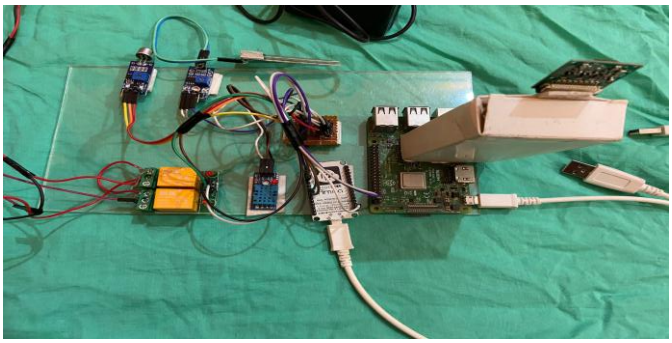

Fig -4: IOT Sensor network with mcu, raspberry pi and attached pi camera.

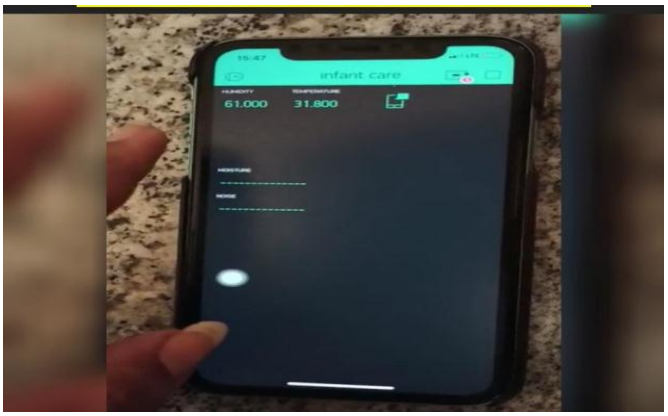

Fig -5: result displayed on blynk app

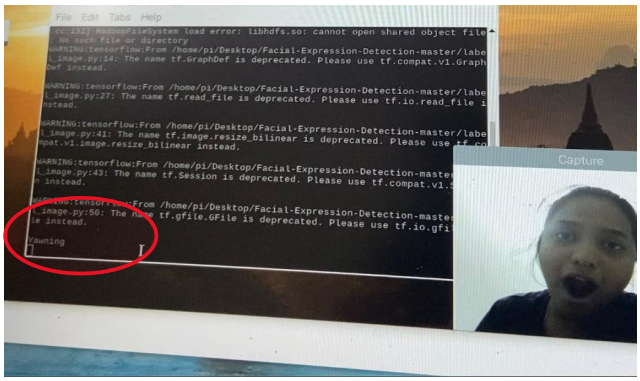

Fig -6: real time face detection and emotion prediction (Prediction of yawning emotion)

7. CONCLUSIONS

The idea revolves around automating all the process which can result in saving time and effort of the parents and ensuring proper monitoring and soothing of the child. the implementation will result in time saving and cost effective.in future this project can be further enhanced by using advanced hardware and software tools such as Bluetooth, robotics components, other sensors etc.

The enhanced prototype can be used in hospitals for paralyzed patients or neo natal intensive care units etc.

Thus, it has a very larger scope in future and way more use cases can be introduced.

REFERENCES

[1] Samir K. Bandyopadhyay proposed, "A Method for Face Segmentation, Facial Feature Extraction and Tracking" IJCSET | April 2011 | vol.no:1, issue 3,137-139 [8] Gonzales and Woods, —Digital Image Processing||, Pearson Education, India, Third Edition.

[2] Misha Goyal and Dilip Kumar, "Automatic E-Baby Cradle Swing based on Baby Cry", International Journal of Computer Applications 71(21):39-43, June 2013.

[3] Y. Lavner, R. Cohen, D. Ruinskiy and H. Ijzerman, "Baby cry detection in domestic environment using deep learning," 2016 IEEE International Conference on the Science of Electrical Engineering (ICSEE), Eilat, 2016, pp. 1-5.

[4] A. Mercy Rani, R. Durgadevi, "Image Processing Techniques to Recognize Facial Emotions", International Journal of Engineering and Advanced Technology (IJEAT) ISSN: 2249 – 8958, Volume-6 Issue-6, August 2017.