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INFANT MONITORING SYSTEM USING RASPBERRY PI

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Abstract - In today's situation, parents are busy in their career. As in India that both the parents need to work and look after their infants, so more workload and stress is there on such families especially on female counterparts. Therefore, the chance of providing better infant care is reduced. This may cause many troubles to the health of children. For this, temperature, moisture, motion and sound sensors. So that the system can monitor the external conditions like increasing body temperature, crying of the baby when the voice exceeds the pre-determined range, movements of the baby, when found to be moving continuously and also indicates when the diaper is needed to be changed, if excess wet was observed. This system is attached with a video camera which is operated based on the instructions from the raspberry pi pico and is used to capture the video when the motion sensor detects the baby's movements continuously. The video will be displayed on the screen to monitor the baby.

Key Words: PIR sensor, sound sensor, moisture sensor, image processing, open cv, blynk app

I. INTRODUCTION

The present day and age calls for both working parents. This situation requires a product which would assist parents in taking care of their babies. The Intelligent Baby Care System has an Infant Monitoring Unit which employs cloud computing and IoT. This unit monitors the baby and its surrounding and stores information regarding the same. It also has a Data Analysis System which makes use of audio processing and image processing to detect and classify the causes. It is an innovative, smart and protective baby care system to nuture a baby in an efficient way. This system considers all the minute details required for the care and protection of the baby. The design of smartness and innovation comes with the use of technologies and methodologies which include Internet Of Things (IOT), modules like Raspberry Pi, humidity and temperature sensing, cry detecting mechanism, video surveillance, cloud computing for data storage. In order to detect each and every activity of baby, different sensors and modules are attached wet sensor for detection of wetness of the bed, a camera on top for video footage and cry detection circuit to analyze cry patterns. All the data which is being taken from the sensors and modules will be stored in cloud and analyzed at regular intervals. An instant notification through email and SMS will be generated if any abnormal activity is detected such as crying, wetness of bed.

II. LITERATURE SURVEY

1 Knight's Wireless Baby Monitor [2014]

The pediatrics academy in America changed the policy declaration on infant death. It focuses, in the recent years, to provide an environment characterized by safety sleep in order to reduce the number of infant and kids' deaths. The Knight's Wireless Baby Monitor was designed with some features presented by individual wireless baby monitors in a single, integrated stand-alone monitor located on top of the baby's bed with full sensors. There will be a sensor for temperature, a sensor for motion, an audio sensor to resist accidental choking and suffocation in bed. Video, audio and the temperature of the infant will be accessible through the smartphone. The system contains three components: monitor part, alarm part and smartphone device. The main part is the monitoring in which various sensors, microprocessors, communications chip and batteries will be installed. The alarm part is a separated unit that can be placed at the end of a table, dresser, or other flat surface near an electrical socket. When the communication chip receives an alert from the monitoring part, the alarm part will flash a warning light and sound an audio alarm. The system provides a safe sleeping environment for children under the age of one year or less to reduce the infant mortality.This system has some disadvantages:

- It is suitable just for babies that are one-year-old or younger.
- It does not measure room temperature.
- It can connect via Wi-Fi but does not provide connection through local network.
- It not allows parents to hear the baby's voice and talk to them.
- It does not provide cry detection feature.

2 Integrity Baby Monitoring System [2014]

The design of a GSM-based smart baby monitor system aims to provide better care for children. This system observes important parameters such as body temperature, humidity status, pulse rate, movement of an infant, and the use of GSM network, this information is transferred to their

parents. Parameter details can be sent to the parents with alarm so any action can be taken. The system design consists of sensors for observing important factors, LCD display, GSM interface and sound alarm all controlled by one microcontroller. This system has some disadvantages:

- It cannot sense the room temperature and humidity.
- It does not support Arabic language.
- It does not have a mobile application
- It does not have live video and audio streaming.
- It does not provide cry detection feature.
- It does not support the awake or sleep feature.

3 Baby Monitoring System (Middle East Technical University) [2016]

This system has some properties such as observing the baby's heart rate, measuring the baby's temperature and notifying the parents if a fever occurs and provides sleep cycle detection for detecting sleeping illnesses or showing current sleeping stage. By using the statistical data from the application, it will be possible to predict the baby's sleep habits and ideal sleep conditions.This system has some disadvantages:

- It cannot sense the room temperature and humidity.
- It does not have the ability to talk to the baby.
- It does not support Arabic language.
- It does not provide cry detection feature.
- It does not support wake up or sleeping feature.

4 Infant Monitoring System using Multiple Sensors [2016]

This is an efficient health observing system for babies, using sensors that can placed with baby clothes and connected by wireless connectivity. This system involves completely integral Electrocardiography (ECG), temperature and Carbon dioxide (CO2) sensors everywhere around the baby's bed. This health monitoring system provides a real-time signal of any variations in the infant's status and can be used in Neonatal Intensive Care Units (NICU) and at home as well. Sudden Infant Death Syndrome (SIDS) is an unjustified death of a child under one year of age. This usually occurs without any warning signals during sleep, which is why it is difficult to identify and predict. This monitoring system will therefore be an effective method of predicting the emergence of SIDS. This system has some disadvantages

- It does not support Arabic language.
- It does not have a mobile application.
- It does not have live video and audio streaming.
- It does not provide cry detection feature.
- It does not support wake up or sleeping feature.

5 Automated Child Monitoring System [2016]

In this system, a Raspberry Pi device connected to static camera and the movement of the camera is made dynamic using motors and other infrared sensors. The camera will be placed in the center of the room in order to cover all directions. The captured video can be streamed online and the parents can sign in to a website to access any information or updates. In addition, a GSM module is connected with Arduino which sends alert notifications whenever the camera is rotated. This system has some disadvantages:

- It does not support Arabic language.
- It does not have a mobile application
- It does not provide cry detection feature.

6 Advanced Baby Monitor [2017]

This project presents the design of advanced baby monitoring system using Raspberry Pi . Parameters such as humidity, temperature; movements of the infant are also monitored and the baby's sleep and sleep sequences are automatically recorded as a means by which parents could remotely observe and monitor their baby. A camera is used so that the observer and the parents can view it. This system architecture consists of sensors to monitor important parameters such as temperature and humidity sensor, motion sensor and sound sensor, which includes s microphone. The details of the parameter are sent to the parents by the alarm so if any action occurs can be taken.This system has some disadvantages:

- It does not support Arabic language.
- It does not have a mobile application

7 Arduino Based Infant Monitoring System [2017]

This monitoring system is based on the Arduino microcontroller. It can record and store any observed information related to the infant and transmit it to a computer. Staff in the neonatal intensive care unit (NICU) for diagnostic or research studies may transmit the data recorded by the system. The observation system used in this research is equipped with an incubator containing sensors to measure the amount of humidity and heart rate. It has been connected to the

baby to monitor the heartbeat in particular. The measured results, like humidity level and pulse rate are sent to the computer by the Arduino device interface. This system has some disadvantages

- It does not support Arabic language.
- It does not have a mobile application.
- It does not have live video and audio streaming.
- It does not provide cry detection feature.
- It does not support wake up or sleeping feature.

III. PROBLEM STATEMENT

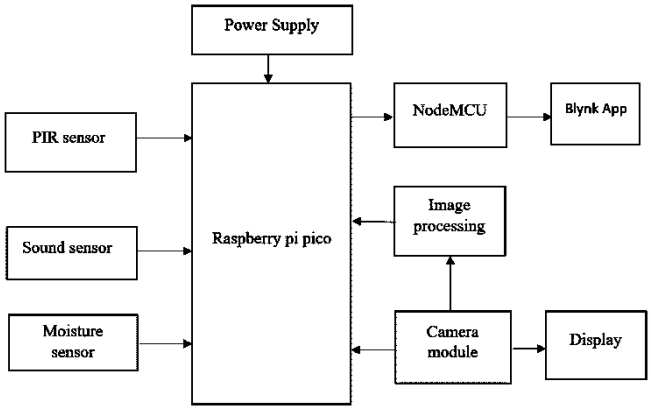
Due to unpredictably occurring illnesses, accidents, or heat stroke, many children pass away without their parents even realizing it. Without an adequate detection and alert system, it is challenging to be aware of the issues children, particularly those between the ages of 0 and 3, are facing because children are unable to communicate their problems or even their pain to others. Because parents can't be with their children all the time for a variety of reasons, including employment and other commitments, the majority of parents nowadays have begun to leave them alone. Caretakers or others nearby may not be aware enough of the children's problems to recognize them at the earliest stages.

IV. METHODOLOGY

4.1 Overview

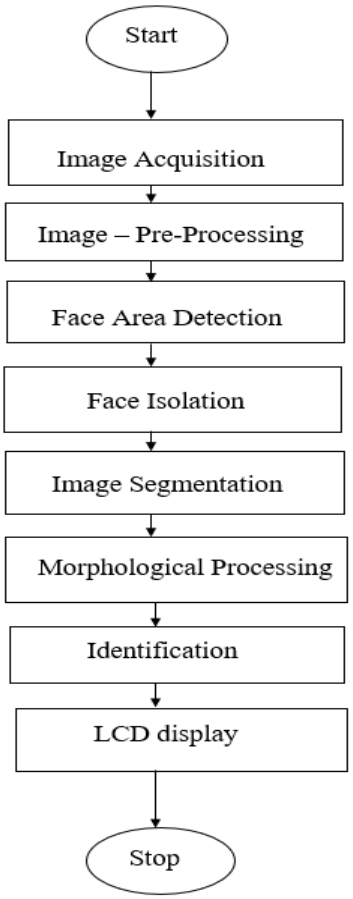
In proposed methodology is an infant care system which consists of an infant monitoring system, data transfer module and data analysis module. The Infant Monitoring System collects data from the various sensor and control the features. The Data Transfer module is used as medium for transfer of data between the user, Infant monitoring system and the Data Analysis Module. The Data analysis module analyses the data collected and draws various conclusion for future use.

4.2 Block Diagram



For picture processing and display, a camera module is linked to the Raspberry Pi Pico, which also receives data from sensors. This system connects NodeMCU to the Blynk app, enabling notification transmission through that app.

4.3 Flowchart



4.4 Working

Infant monitoring using Raspberry Pi Pico with NodeMCU and Blynk app can be accomplished using the following steps:

- Connect the Raspberry Pi Pico and NodeMCU using serial communication (UART) protocol.
- Connect sensors such as temperature, humidity, and motion sensors to the NodeMCU to monitor the infant's environment.
- Connect a camera module to the Raspberry Pi Pico to capture images and video for monitoring purposes.
- Install the required libraries for the sensors and camera module.
- Create a Python program to capture images and video from the camera module and send the data to the NodeMCU over serial communication.
- Write a program for the NodeMCU to read the data from the serial port and send it to the Blynk app using the Blynk API.
- Download the Blynk app on your mobile device and create a new project.
- Add the required widgets such as Gauge, Value Display, and Video Stream to the project.
- Connect the Blynk app to the NodeMCU using the Blynk API key and Wi-Fi credentials.
- Write a program to receive the data from the NodeMCU and update the widgets in the Blynk app accordingly.
- With these steps, you can monitor the infant's environment and receive alerts on your mobile device in case of any abnormal conditions such as high temperature, humidity, or motion. You can also view live video streaming and check the infant's status at any time.
- The sensors in the system continuously collect data on the infant's vital signs and environment.
- This data is typically collected by a microcontroller or a computer, which processes the data and sends it to a monitoring device or a cloud-based platform.
- The data collected from the sensors is processed and analyzed to detect any abnormalities in the infant's vital signs or environment.
- The system may use machine learning algorithms to detect patterns in the data and predict any potential health risks.
- In case of any abnormal conditions detected, such as high temperature or irregular breathing patterns, the system generates an alert.
- The alert can be sent to the monitoring device, such as a smartphone app, via a notification or an alarm.
- The system continuously monitors the infant's vital signs and environment, providing real-time updates to the monitoring device or cloud-based platform.
- This allows parents or caregivers to monitor the infant's status and make informed decisions regarding their care.
- Overall, infant monitoring systems are designed to provide parents or caregivers with peace of mind by continuously monitoring the infant's vital signs and environment and alerting them in case of any abnormal conditions.

V. SCOPE OF THE PROJECT

- In this system the notification can be send through blynk app.
- This system is attached with a video camera which is operated based on the instructions from the microcontroller and is used to capture the video when the motion sensor detects the baby's movements continuously.

VI. RESULT

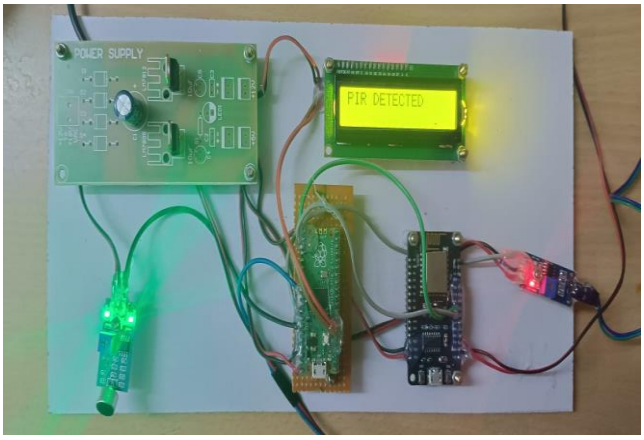


Fig -1: Results of a sensor displayed in LCD module

Fig -2: Results of a segmentation

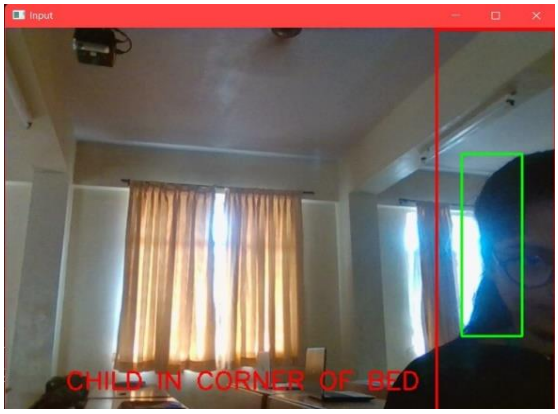


Fig -3: Results of edge detection

VII. CONCLUSION

Baby care is a challenging issue that affects everyone. Children are the future of society. This system will highlight how crucial baby care is. The working parent, as well as nurses and baby care centers, will find this "Baby Monitoring System" to be both affordable and user-friendly. A cheap and easy-to-use baby monitoring system has been proposed, and it has the potential to enhance parent-child communication. This is a useful approach for keeping track on the infant's health from a distance. Additionally, it can be applied when a person's family needs to confirm that the baby is healthy. To protect the baby's safety, it may, for instance, monitor the baby's condition while reducing the number of hospital staff members. To forecast the movement of the baby, this study may one day be expanded into the field of machine learning. This proposed task is very effective and economical in identifying abnormal circumstances and estimating the position of the baby.

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