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Design of Newborn Mood Indicator System

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ABSTRACT-

A cradle is a piece of equipment used to put infants to sleep. A system developed that can help parents to monitor their baby's health and other activities. Also any unusual activities can also be tracked and so that immediate care can be given .This prototype can help in continuous monitoring of the infants and detects if there is any abnormality by certain sensors that is implemented here. Various reasons for crying a baby like peeing, pooping Hunger cry, emotional cry. Frequency produced during a cry is captured by the sensor For instance the hunger cry, physiological disturbance cry, illness cry etc. can be monitored accordingly. If there is any motion, such as urinating or a baby awakening from sleep, foul smell detection is determined and also a rocking motion is given to the cradle which makes the crying baby asleep again Therefore it is a system to determine the state of the baby even in the absence of the parents.

Keywords— Smart cradle, Arduino microcontroller, PIR (passive infrared) sensors

1. Introduction-

The parents cannot continuously monitor their babies. The particular reason for these circumstances is that they are accompanied with their busy schedule. So during their absence, the baby's activities can be tracked, indicating the parents about the baby's state. If the baby starts to cry, due to some disturbances there is a need for an alarm system to give some attention to the baby. Various monitoring is also required that would make the parents be updated about the baby's state. This cradle is used to put the babies to sleep. A side by side swinging motion of the cradle is implemented, if the baby doesn't fall asleep due to certain Disturbance. To plan this, certain sensors are involves that includes, PIR motion sensor (if motion of the baby detected), Rain sensor (if the baby pees), Gas sensor (for foul smell detection) Temperature sensor (to detect temperature), Sound sensor (to detect the cry of the baby), that it interfaces with the servo motor to make swinging motion in the cradle. Crying pattern of an individual baby is recorded. And varying cry frequency is Analyzed and categorized as such the reason behind the cry is detected and monitored. The varying frequencies of the baby's cry is programmed and if those frequencies are reached when the cry occurs, the reason of the crying possibilities is displayed accordingly. (i.e) interfaced with a sound sensor. By this the reason behind the baby's cry can be monitored accordingly. A cradle is a piece of equipment used to put infants to sleep. The side-to-side rocking motion of the cradle calms the infant and induces slumber. Parental manual labor is required to rock the cradle in order to create a swinging motion. When the infant is in the cradle, the parent must continuously monitor the child to keep tabs on their activities. The suggested design in this smart cradle concept will enable the cradle to seamlessly interface with a smartphone, typically an android device. All necessary sensors and hardware parts will be put together.

2. LITERATURE SURVEY

2.1 Smart Baby Cradle

(2015) Aniruddha Rajendra Patil et al. The suggested design in this smart cradle concept will enable the cradle to seamlessly interface with a smartphone, typically an android device. All necessary sensors and hardware parts will be put together using an Arduino microcontroller. There will be continuous observation of the infant inside the cradle.

2.2 Baby Cry Detection: Deep Learning and Classical Approaches

Under difficult signal-to-noise ratio conditions, Rami Cohen et al., 2021, investigated deep learning and conventional methods for baby cry sound recognition in diverse residential settings. As well as in medical and psycho-social research, automatic cry detection is used in commercial products (like infant remote monitoring).

2.3 Automatic cradle system for infant care

Swapnil Bhatnagar,et al.,2021

A cry analysis system that determines the baby's cry pitch for Infant Car or Infant Care causes the cradle to rock as a result. It could produce six rocks each minute at most. A call or message will be sent to the nurse or the parent's mobile phone via GSM if the baby doesn't stop screaming within a specific amount of time, alerting them that the baby needs to be cared for.

2.4.Acoustic analysis of baby cry:

Rodney Petrus Balandong et al.,2013,With the use of a passive infrared (PIR) sensor, acoustic analysis reveals indications of malfunctioning at the newborn development space. The movement of a child in a cradle is visible thanks to a passive infrared (PIR) sensor. Infant movements that would otherwise cause a buzzer to sound and draw attention from adjacent people are eliminated. cradle swinging while taking the child's comfort into consideration.

2.5 Baby monitoring smart cradle

According to Karunakar Reddy et al., 2019, a variety of baby cry databases are accessible and can be utilised as cry samples for infant and young baby cry analysis investigations. The sensors in this system architecture, such the Arduino Mega and DTH11 (digital temperature and humidity temperature), are used to keep track of important data.

2.6 Design and fabrication of automatic E- cradle:

In Mr. Canute Sherwin et al.'s planned design for 2021, a circuit will be installed along the cradle to sense the sound intensity of the child's cry and take the appropriate steps in response.

2.7 Design of smart cradle for infant health.

Monitoring system using IOT:

Megha Dangi et al.,2020 created a cutting-edge cradle system that keeps an eye on a baby's health concerns like temperature, crying, and wetness. Parents can operate the cradle using their smartphones in addition to monitoring it.

2.8 Smart cradle:

Bodla Sanjana et al., 2022 project highlights the development of a novel smart cradle design and execution. A sound sensor, servo motor, micro-SD card module, and rain sensor were used in this. The cradle swings automatically with the aid of a servo motor when the sound sensor detects a baby's cries, and it also plays a lullaby and activates a toy. When the mattress becomes wet, the rain sensor sounds an alarm.

2.9 Smart cradle with automated baby monitoring system:

Amit et al., 2021 include features including an automatic cradle swing, live streaming of the infant's activities, and phone or handheld device notifications for parents in case the baby cries or tries to escape the cradle.

3.HARDWARE DESCRIPTION

The Components used in this project are

- Arduino UNO
- Rain sensor
- PIR sensor
- Sound Sensor (KY-038
- Gas sensor MQ-2 sensor
- 16*2 LCD display
- piezo buzzer
- Servo motor

- Jumper wires

3.1. ARDUINO UNO:

The most common board, the Arduino Uno, is arguably the greatest option for a beginner. The board can be directly connected to the computer using a USB cable, which serves as both a serial port and a power source.

Pin explanation:

- **Vin:** This pin is used to supply input power from an external power source on the Arduino board.
- **5V:**The Arduino board's 5V pin serves as a controlled power supply voltage, supplying power to both the board and its internal components.
- **3.3V:** This board pin is used to supply a 3.3V supply that is produced by a voltage regulator on the board.
- **GND:** The Arduino board is grounded via this board pin.
- **Analogue Pins:** The analogue input range for the pins A0 to A5 is 0 to 5 volts.
- **Digital Pins:** The Arduino board uses pins 0 to 13 as digital inputs and outputs.
- **Serial pins:** Another name for these pins is a UART pin. The Arduino board and other devices can communicate with one another via it. Data is transmitted and received, respectively, using pins numbered 1 and 0 for the transmitter and receiver, respectively.
- **LED pin**:Digital pin 13 on the board is used to power an integrated LED. The LED doesn't start to glow until the digital pin is high.

3.2.PIR SENSOR:

Passive infrared (PIR) sensors measure the infrared radiation emitted by objects within their field of view (FOV). It is a sensor composed of pyroelectric material, which generates energy when heated. This sensor is employed to find little movements nearby. It responds quickly and offers simple interfaces.

Specification:

- 5V DC working voltage
- movements between 10 and 80 cm.

Pin configuration:

- Pin1 (VCC): 5V DC
- Pin2 (GND): ground pin
- Pin3 (DO): digital pin D2

3.3. RAIN SENSOR:

- One type of switching device used to detect rainfall is a rain sensor. This sensor module allows users to measure moisture via analogue output pins, and when the moisture threshold is exceeded, it produces a digital output.

Specification:

- 5V is the necessary voltage.
- The little PCB measures 3.2 cm by 1.4 cm in dimension.

Pin configuration:

- Pin1 (VCC): 3.3V DC
- Pin2 (GND): ground pin
- Pin3 (DO): digital pin D4

3.4 .SOUND SENSOR KY-038:

One form of module used to pick up on sound is the sound sensor. This module is typically used to measure sound intensity. This module is mostly used for switch, security, and monitoring purposes. For convenience of use, the precision of this sensor can be altered.

Pin configuration:

- Pin1 (VCC): 5V DC
- Pin2 (GND): ground pin
- Pin3 (DO): digital pin D9
- Pin4(A0): analog pin A2
- I/P pin to servo motor

3.5.GAS SENSOR MQ-2:

The MQ2 sensor is one of the most widely used in the MQ sensor series. It is a MOS (Metal Oxide Semiconductor) sensor. Metal oxide sensors are also known as Chemical resistors because sensing is based on the change in resistance of the sensing material when exposed to gasses.

Specification :

- Operating voltage: 5V DC
- Power consumption:800mW
- Gas detection such as: LPG, Smoke, Alcohol, Propane, Hydrogen, Methane and Carbon Monoxide
- Gas Detection range :200 to 10000 ppm.

Pin configuration:

- Pin1 (VCC): 5V DC
- Pin2 (GND): ground pin
- Pin3 (AO): analog pin 0

3.6.LCD 16×2 DISPLAY:

Liquid crystal display is referred to as LCD. These displays are mostly preferred for seven segments and multi-segment light-emitting diodes. The primary advantages of adopting this module are low costs simply programmable, animations, and there are no limitations for displaying custom characters, special and even animations, etc. The 16×2 LCD pinout is shown below.

3.7. PIEZO BUZZER:

In its most basic form, a piezo buzzer is an electronic gadget that emits a tone, alarm, or sound. It is usually a cheap product, lightweight, and has a straightforward design.

Pin configuration:

O/P pin to digital pin 11

3.8. SERVO MOTOR:

You can use the two simple examples in this tutorial with any Arduino board.

Specification:

- Operating Voltage is +5V typically
- Torque: 2.5kg/cm

Pin configuration:

- Pin1 (VCC): 5V DC
- Pin2 (GND): ground pin
- Pin3 (DO): D3 pin

3.9.JUMPER WIRES:

A jumper wire is an electric wire that connects remote electric circuits used for printed circuit boards

The configuration of the jumper wire used here is,

- **MALE-MALE** configuration
- **MALE-FEMALE** configuration
- **FEMALE-FEMALE** configuration

4.SOFTWARE DESCRIPTION

4.1. ARDUINO DEVELOPMENT ENVIRONMENT

- Write, compile, and upload code to practically all Arduino Modules using the Arduino IDE, an open-source program created by Arduino.cc.
- Because it is an official Arduino program code compilation is so simple that even the average individual with no prior technical expertise may get started learning.
- It works on the Java Platform and is compatible with all operating systems, including MAC, Windows, and Linux. It has built-in functions and commands that are essential for debugging.
- the code's revision and compilation.
- Several Arduino modules are available, including the Uno, Mega, Leonardo, Micro, and many others.
- On the board of each of them is a microcontroller that is actually programmed and takes data in the form of code.
- The primary code, often referred to as a sketch, written on the IDE platform will eventually produce a Hex File, which is transported to and uploaded into the controller on the board.
- The Editor and Compiler are the two primary components of the IDE environment. The Editor is used to write the necessary code, while the Compiler is used to compile and upload the code into the designated Arduino Module.
- Both C and C++ are supported in this environment.
- Most of the IDE environment is distributed
- split into three halves
- Text Editor Output in Menu Bar Pane
- Sketches are computer program created using the Arduino Software (IDE). The text editor is used to create these sketches, which are then saved with the file extension.
- The editor offers functions for text replacement and text searching. When saving and exporting, the message section provides feedback and shows errors.
- The console shows text generated by the Arduino Software (IDE), including error messages in their entirety and other data. The configured board and serial port are visible in the window's bottom right corner. You may create, open, and save sketches, validate and submit program view the serial monitor, and more using the toolbar buttons.
    - setup () is a function that is executed just once at the beginning of a program to initialize settings.
    - a function called loop () a procedure that is called repeatedly until the board shuts down used for burning a bootloader to the new microcontroller.
- **Help -** In case you are feeling skeptical about software, complete help is available from getting started to troubleshooting.The top bar is referred to as the Menu Bar and offers the following five options.
- **File:** You can create a new window or reopen an existing one to write the code. The number of additional categories into which the file option is divided are displayed in the following table.The Output Pane will display the code compilation as you click the upload button as soon as you visit the preference area and check the compilation section.
- **Edit -** Used to copy and paste the code with additional font modifications.

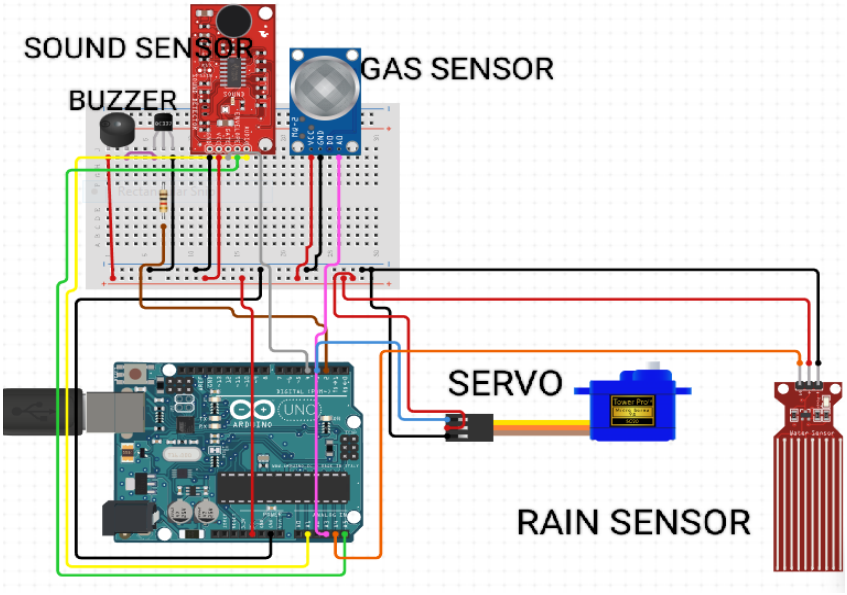
Sketch is used for programming and compiling.Tools are primarily employed in testing projects. A bootloader is burned to the new microcontroller using the Programmer part of this panel.

4.2. EMBEDDED C LANGUAGE

- In order to address the issues of commonality amongst C extensions for various embedded devices, the C Standards Committee developed Embedded C as a set of language extensions for the C programming language.

- The main() function, variable definition, data type declaration, conditional statements (if, switch case), loops (while, for), functions, arrays and strings, structures and unions, bit operations, macros, and so forth are just a few examples of the syntax and semantics that are used by embedded C.
- It is used to programme microcontrollers and processors in sectors like automotive, industrial automation, consumer, aerospace, and medical applications. It is suitable for developing programmes that must directly connect with the hardware because it is a low-level language with direct access to the hardware.

5.CIRCUIT CONSTRUCTION:



6. METHODOLOGY

- **Design:** The first step in developing is to design the New born Mood indicator system. This includes defining the overall system architecture, hardware components, and algorithms that will be used to process the data. This design should also include safety and reliability considerations.
- **Sensor Selection:** The next step is to select the sensors that will be used for the New born Mood indicator system. This includes considering factors such as accuracy, precision, sensitivity, cost, and compatibility with the system design.
- **Signal Processing:** Once the sensors have been selected, the signals from the sensors must be processed and analyzed to obtain meaningful information about the baby cry frequency level This process typically involves signal conditioning, filtering, and feature extraction algorithms.
- Here in this chapter the system implementation requirements of the project. Different types of sensor used in the project for analyzing the baby cry frequency.

Sound Sensor: when the baby starts crying, a noise sensor detects the sound of the baby's cry and sends the signal to the Arduino Uno. And interface into the servo motor to make the cradle swing whenever necessary.

Rain sensor: when the baby pees on the bed we can detect the water content signals to the Arduino Uno, which then send signals to the buzzer which acts as the alarm .

PIR Sensor: PIR motion sensor is a passive infrared sensor that detects the baby movements in the environment. It operates on the idea of an altered infrared light signal.

Gas sensor: The foul smell from the baby's cradle is determined indicating the pooping condition of the baby.

Arduino Uno:Arduino uno is popular microcontroller which is used in development of small scale projects In the cradle system the sensors are connected to the board send signals to the microcontroller which processes them and provide with desired output

7.DESIGN AND IMPLEMENTATION

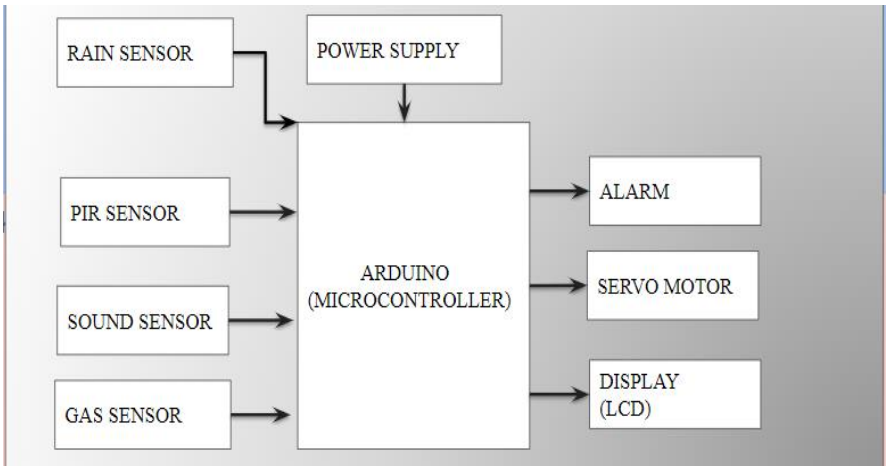


Fig 1 Block diagram

7.1. INTERFACING RAIN SENOR, PIR SENSOR ,SOUND SENSOR(Including servo motor),GAS SENSOR,LCD DISPLAY WITH ARDUINO UNO

Connect the power supply to the Arduino board.

- Connect the Rain ,Sound ,PIR ,Gas sensor to the Arduino board.
- Then connect the LCD display to the Arduino board.
- Program the Arduino board to receive the input from the sensors and the display.
- Test the connection by sending a signal from these sensors.
- The code of the C program should consist of the results of which ,the reasons behind the cry analyzed.
- Program the Arduino board to display the baby cry frequency level on the display.
- Troubleshoot any issues that may arise during the process.
- Once the components are interfaced properly, test the complete system by measuring baby cry frequency level.

8.RESULT:

Thus to monitor the performance of the baby the sensors play a major role and then the result is supervised in the display screen ensuring the baby's state. The servo motor is annexed to the cradle so that it makes the swinging motion to make the baby fall asleep whenever crying sound is identified.

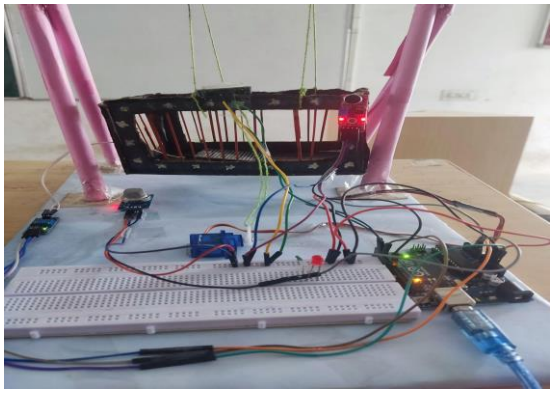


Fig 2 OUTPUT

9.CONCLUSION

Newborn mood indicator system is secure technology for the parents to analysis the risk factors, and also takes an initiative in determining the reason behind a baby's cry with the crying frequency, thereby equipping the baby with the essential care that is to be given. These systems use sensors or other technologies to detect the different types of sensory deflections obtained from the surrounding of the baby defining the state of the baby Hence the presence of the parents is not needed all the time to watch out for the baby.

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