# Smart Infant Care System

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**Abstract— A woman faces various complications in life but when the choice is between her baby and work, it's always her baby without a second thought sacrificing all her career possibilities. It is always not possible for a mother to be beside her baby throughout the time. As in such situations require the need of an nanny which becomes expensive most of the times, therefore a need of a smart way of monitoring and managing the babies is an extreme must. There have been many proposed systems to solve this problem and a number of devices that can be found in the market doing some monitoring and recording tasks too and in this paper some of their assets and liabilities will be sectored and discussed briefly. The suggested system here is a microcontroller and a mobile application based total care system for infants. The set-up monitors the ambient conditions, provides various notifications regarding medical and the food routine of the subject ,provides a real time surveillance on the subject and in case of emergency can send out alerts and set alarms ON. The paper here also discusses about the future aspects of the system.**

**Keywords—** ***infant and baby care; monitoring and surveillance; alerts and alarms; mobile application ; ambient conditions ;cradle swaying; real time video streaming; notifications and pop-ups.***

## I. INTRODUCTION

In current times, with an ever-changing ,easy and fast going life taking care of the infants has become one of the most exigent tasks for both the working and non-working class of parents. Especially when it is the matter of infants falling sick, totally relying on an unknown human support is like putting one's life at stake. Here arises the need for a technical system that can make the parenting job easier and can help the guardian have a constant supervision in their absence and also provide an extra mile in taking care of the infant.

Even if a supervision of an elderly is required during the early stages of a child, the presence of the carer all the time is not possible as the person might be indulged in some other activities in the same premises. Thus remote monitoring has been one of the key objectives of infant care system. The supervision is undertaken in audio as well as video ways in most of the current baby monitoring devices in the market. Also, the trend of automated home application systems have led to one's control over the various electrical and electronic home appliances into just a push-button task from their mobile phone itself. A busy mother can change the temperature of the AC from a different place, the carer can turn on and off the lights and fan remotely just by observing the changes in the surrounding conditions of the baby. Different reminder applications on a person's cell-phone these days have helped one keep their lives punctual and disciplined. Keeping a track of a baby's feeding routine and medical appointments is very essential as the health is the most important factor of an infant.

Wireless technology has made the work of remote monitoring a simple task. The devices working on this technology needs to be well apt with efficient network connection, less space consuming and very importantly these days: easily accessible via a mobile phone.

This suggested system integrates various functions of the infant care systems available in market in an elementary fashion. It is a microprocessor based system which gives a cheap solution to the remote monitoring of the infant, also gives various control over some of the common home appliances such as the lights and fans of the rooms where the infant is. The simple mobile application of the system gives the solution to the real time monitoring of the infant and lets the user send alerts and alarms in case of emergency. The application gives away necessary notifications of the infant's wellbeing.

This paper has been sectored into seven parts. The first dealing with the introduction to the proposed system. With the succeeding section to be the brief discussion of the key elements of an infant care system, where some of the previous work done on the same field will be deliberated briefly. The third section comprises of the explanation of the proposed system. The fourth part consists of a cursory review of the hardware and the software employed in the system. The fifth section includes the outcomes; the sixth section provides the later prospects of this system. Finally the last section belongs to the summarization of the system proposed and the paper.

## II. KEY ELEMENTS

### *A. Real-Time Monitoring and Discomfort Detection*

Video monitoring is always advantageous as well as more confirming then getting notified by mere words from the carer for the parents. One of the systems have proposed video monitoring to calculate the discomfort of the baby and then classify [1]. The system is based on supervised learning and uses face detection. The spurious positives and negatives for discomfort classification during the face detection is the major drawback of this system. Another system classifies the discomfort on the basis of the posture of the infant [2] using the concept of an array of switches that would classify different

positions of the infant on the crib. This system involved careful computing of the spacing between the switches making the system tedious and also false posture classification is a setback of this system. Other monitoring devices consisting of vests or belts which the infant is made to wear[3],[4],[5] have the advantage of remote monitoring but because of their close proximity to the infant there is always a chance of failure as the device might provide an obstacle to the infant's movements .

### *B. Notifications of Food Routine and Medical Care*

A general reminder application on a mobile phone is very useful to keep in check of all the activities to be done in check. But jotting down the time to time food and medical care routine can be a hectic job. The available applications are not for free. Downloading such remainder and tracking applications are an extra cost that has to be paid [6], [7].

### *C. Ambient Check Detectors*

There are many integrated home automated applications now a days in the market [8], [9], [10].The advancement in wireless technology has led to controlling of the home appliances remotely has become a very facile activity.

### *D. Cradle Automatic Sway*

The traditional way of calming a child is by rocking the baby. A study had proposed of analyzing the discomfort of an infant using feature extraction at first and then using proper algorithm for verifying the action of crying of the infant [11].Such systems have a high probability of error due to the complicated calculations of the algorithm.

## III. PROPOSED SYSTEM

The proposed system is a microprocessor based basic android application system. One can have online streaming of the real time activities of the infant via the mobile app. Since it is very fundamental and a known fact that infants express their discomfort by crying and weeping. We can actually monitor that via the webcam of the mobile app and start swaying the cradle as also known as the conventional method of calming a crying baby and also for putting the baby to sleep.

The next most important aspect is the nutrition concern of the infant. The infant has to be given proper meal in its initial development years. Vaccination dates and some periodic health checkups are all a part of the early years of a child. Hence this system also gives out proper notifications of the child's feeding schedule and important medical dates.

For security reasons, keeping in mind of the system's application in maternity wards, RFID authenticated entry has been included in the system. Apart from this, basic ambient condition detectors such as temperature and gas are a part of this system. Based on their output, the fans and lights of the rooms can be controlled by the user of the android based mobile application. Another safety feature is that alert messages can be sent via the mobile application to any reliable person in case of emergency.

## IV. HARDWARE AND SOFTWARE FRAMEWORK

The prototype uses a pic18F4520 microcontroller with three SPDT 12V relays with BC547 relay drivers of 5V each for light, fan and gas respectively. MQ-2 gas sensor, LM35 temperature sensor and a buzzer has been employed in the prototype. A DC motor L293D is used for cradle swaying. A RFID reader with a Wi-Fi module ESP8266 has been interfaced with the microcontroller. The prototype uses a general mobile phone camera for real time video streaming.

All of these hardware components interfaced with the microcontroller are programmed using MPLAB IDE (with HTPIC compiler.

The mobile application has been designed with the help of B4A application. All the coding and the interface designing for the prototype have been done via the same.)

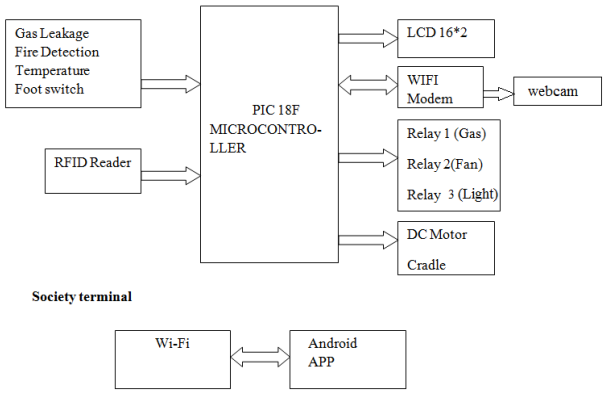


Fig. 1: Basic block diagram of the proposed system

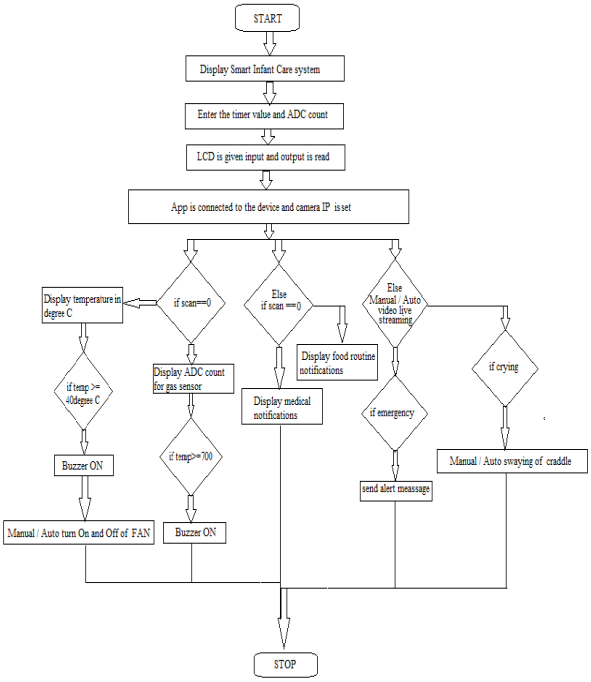


Fig. 2: The flowchart

## V. RESULTS

The prototype of the proposed system gives out pop-ups of vaccination dates as well as the remainders of feeding time. The temperature and gas content in the room can be monitored via the mobile app as well is displayed on the LCD screen as in shown in Figure 3(a). The buzzer beeps twice if the ADC count of the gas

sensor goes above 700 which is basically for the gas leakage odour level. The buzzer beeps once if there is a rise in temperature of more than 40 degree Celsius. The relays related to the fan and the light goes on and off via the control from the mobile app which can set to auto or manual operation via the mobile app again as in shown in Figure 3(b). These changes are reflected as the on-off of the corresponding LEDs of the relays of the prototype .The swaying of the prototype cradle has also been done successfully via the mobile app. The mobile app had achieved its goal of live video streaming via the camera option of the app and the option of sending out an alert message via the app to a reliable phone number has also been possible as in shown in Figure 3(c). The prototype model had been connected via hotspot to the device for testing purpose, which later on if required can be extended to the limits of using the cloud for live streaming.

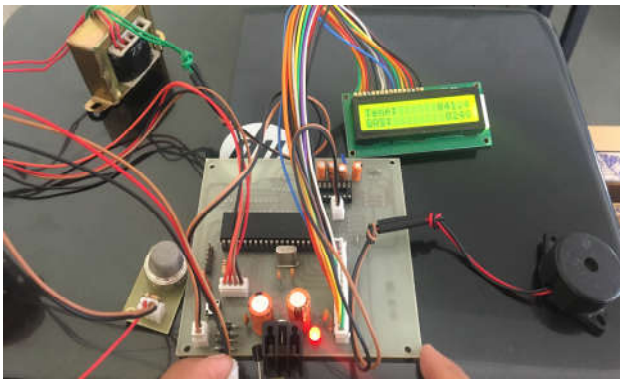

Fig. 3(a): The system LCD displaying the temperature and the gas content

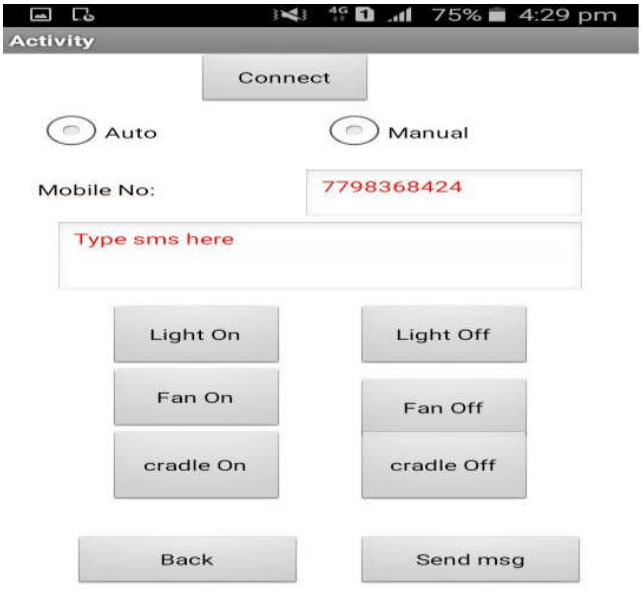


Fig. 3(b): One of the interfaces of the system's mobile application


Fig. 3(c): The other window of the mobile application

## VI. Summary and Conclusion

The prototype has been successfully deployed and the results met the key elements and the requirements discussed in the section II of the paper. This system can be employed for an actual device which would cost much lesser than the already available similar products. The app is based on android so it is easily compatible and the interface being too simple will allow the user to sweep through the options without any hassle. In case of large deployment of this device in places such as maternity wards and child care homes, RFID can be used in a fully fledged scale to entertain only rightfully identified individuals to access the areas where the kids are kept as well as the real time video streaming will provide with 24*7 surveillance over the children. The device can be placed in any right corner of the room of the baby without consuming much of the space and with a proper chassis design; the look similar to digital clock can be given to the device. The device can also be easily connected and can be synced with any of the home automation systems.

## VII. Future Aspects

This suggested prototype can be turned on to a real device. Different types of camera such as the 360 degree rotating ones can be used for better views of the room or ones with better resolution for better picture quality. The system can be integrated with heart rate and respiratory rate measuring systems whose outputs can be sent directly sent to any considering doctor. The mobile app can be modified to operate with other OS as well.

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