Design and Development of a Wearable Device to Monitor Vital Signs of Preggers

L.K.Hema, Velmurugan. S, Bollam Sai Kumar, Rohit Sai .K, Lavan Reddy

Abstract: As the growth of the technology rises day to day but still we cannot able to overlook any wearable device which is the friendliest one for pregnant women. Our proposed system is a wearable device which monitors the health condition of expectant mothers' and transmits data to the respective physician especially in rural areas. With these kind of real time wearable systems, doctors are able to provide higher quality medical services and more personalized healthcare to these women. This health monitoring system would allow a pregnant woman to interact with a physician with almost full functional capability. Preventive measure taken by continuoushealth monitoringof patient from early stages and guidance to avoid prenatal risks is the prime objective of this system. It is only applicable after 16 weeks of pregnancy. The health monitoring device constantly measures the body temperature and heartbeat of the womb and whenever there are fluctuations from the normal value it sends the information to gynecologist at remote place through GSM.The usage of these advanced technologies for pregnant women's care facilitates optimal care to them and thereby pregnancy period mortality can be reduced substantially.

Key words: Temperature Sensor, PPG sensor, Microcontroller, GPS

I. INTRODUCTION

In this scenario expectant woman just wear the tiny device on her belly which incorporates ultrasound Doppler typetransducer in order to measure fetal heart rate and the activity. The wearable device can monitor blood pressure, fetalheart rate by using the sound waves that bounce off from the bodily tissues. From the activity measurements the sleepstates derived. And also it includes separate sensors to monitor the expectant women heart and respiration rate. Thisdevice will help to solve most of their problems related to lifestyle fitness and keep their doctors updated on theirhealth conditions during the pregnancy time. Then she can able to configure this wearable device with her android mobileapp through the wireless Bluetooth module and the collected data can be automatically sent to a doctor who can check the changes periodically.

Revised Manuscript Received on December 30, 2019.
* Correspondence Author

L.K. Hema*, ECE Dept., AarupadaiVeedu Institute Of Technology, Vinayaka Mission's Research Foundation, Chennai, India. , hemalk@avit.ac.in.

Velmurugan S.., ECE Dept., AarupadaiVeedu Institute Of Technology, Vinayaka Mission's Research Foundation, Chennai, India..

Bollam Sai Kumar.,ECE Dept., AarupadaiVeedu Institute Of Technology, Vinayaka Mission's Research Foundation, Chennai, India..

Rohit Sai. K, ECE Dept., AarupadaiVeedu Institute Of Technology, Vinayaka Mission's Research Foundation, Chennai, India..

Lavan Reddy., ECE Dept., AarupadaiVeedu Institute Of Technology, Vinayaka Mission's Research Foundation, Chennai, India..

This device will also help the women in the way of giving early warning to the expectant women and their doctors in case of any possible complications.

II. PROPOSED SYSTEM

The proposed system includes sensor networks attached with the belt type wrap and incorporated with the sensors like, Temperature, Heart rate and Pulse sensor to measure the biological parameters continuously. And in addition to this it has the communication section includes GSM module to communicate with the person at the remote end.
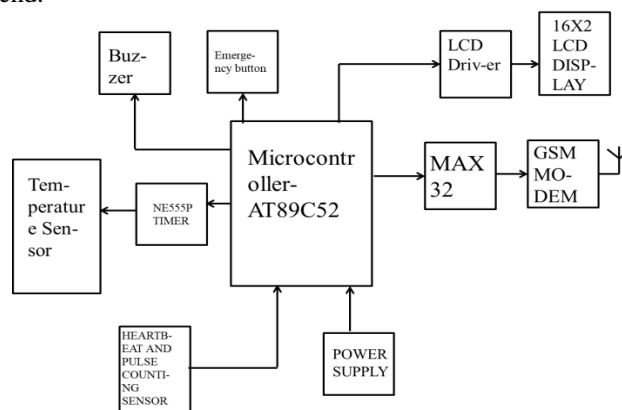

Fig 1 Block diagram of proposed system

III. SYSTEM DESCRIPTION

This system is housed with sensors for measuring the physiological parameter such as temperature, fetal heart rate and pulse rate. These parameters can be processed by the AT89C52 controller. An actuation can be carried by Alarm through buzzer if there is an unexpected change in parameter readings. Also if the level of measured parameters goes beyond the threshold level means. Communication part includes GSM module to intimate the concern at remote end.

IV. HARDWARE DESCRIPTION

Microcontroller-AT89C52

The Atmel AT89 series is an Intel 8051-compatible family of 8 bit microcontrollers used to process the signals from the sensor modules and display the values accordingly. And also actuate the mechanisms in the emergency situations.

GSM with MAX232

GSM/GPRS Modem-RS232 is built with Dual Band GSM/GPRS engine- SIM900A, works on frequencies 900/ 1800 MHz .

The Modem includes RS232 interface, which allow us to connecting PC as well as microcontroller with RS232 Chip (MAX232), which is used to transfer the data to the remote person

Temperature Sensor

In this a thermistor is a kind of temperature sensing device can be used to measure the body temperature of the pregnant women. It measures between 36.5–37.5 °C (97.7–99.5 °F).

PPG sensor

A PPG sensor has been incorporated here to measure the pulse rate of the pregnant women. Photo plethysmography (PPG) uses a simple optical technique to detect volumetric changes in blood in peripheral circulation. It is a low cost and non-invasive method that makes measurements at the surface of the skin.

LCD Display

LCD 2*16 matrix can be connected via LCD driver, where it can be used to display the measured biological parameters such as temperature, heart rate and pulse rate.
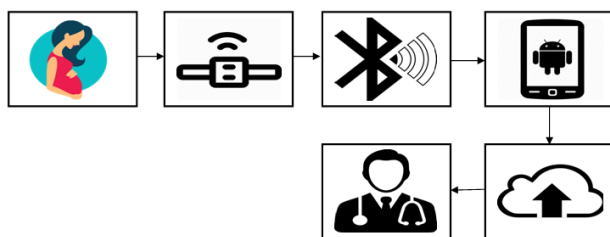
V. SNAPSHOT OF THE SYSTEM DESIGN

Fig 2 Proposed system design

VI. RESULT AND CONCLUSION

Our three-dimensional approach towards this battery operated wearable device and service that we offer is about delivering excellence to our rural women's, safeguarding the environment and ensuring that it doesn't cause any health impacts to the expectant women and her fetal. The main purpose of developing a versatile, cost effective and efficient smart health monitoring system, has been successfully realized at the end of the design process. The entire system is an integration of hardware, software implementations. The pregnant women are advised the tie the wearable module across their womb and the sensors immediately captured the information and same were displayed. This is helping the expectant mother to know about her fetal condition. Also we have guided the pregnant women about the wearing position, how to discriminate between normal and abnormal readings etc., The system designed and developed was tested for various woman and the system has produced expected results.

Fig 3. Fetal heart rate

Fig 4 PPG sensor value

Fig 3 shows the Fetal heart rate for certain time interval and Fig 4 shows the saturation level of oxygen of the pregnant woman , both are shown in the physician mobile using Thingspeak, web computing host so that the data is available in the cloud.

For minor complications the first aid advice was sent through IOT (Thingspeak software) to the expectant mother. In overall the design yield the required output and the major challenge in our project in integrating the fetal heart rate sensor module.

REFERENCES

1. Derbyshire E, Dancey D. "Smartphone medical applications for women's health: What is the evidence-base and feedback?", Int J Telemed Appl2013;11p.
2. Chan M, et al.,"Smart wearable systems: Current status and future challenges",. ArtifIntell Med 2012; 56: 137–156. [PubMed]
3. Gritters J,." Wearable health trackers: A revolution in cancer care". J Natl Cancer Inst 2017; 109: 1--6. [PubMed]
4. Moreira MWL, Rodrigues JJPC, Kumar N, "Postpartum depression prediction through pregnancy data analysis for emotion-aware smart systems, Inf Fusion 2019; 47: 23–31.
5. Free C, Phillips G, Galli L, "The effectiveness of mobile-health technology-based health behaviour change or disease management interventions for health care consumers: A systematic review",PLoS Med 2013; 10: e1001362.
6. Payne KB, Wharrad H, Watts K. Smartphone and medical related App use among medical students and junior doctors in the United Kingdom (UK): A regional survey" .,BMC Med Inform DecisMak 2012; 12.

7. Penders J, et al. "Wearable sensors for healthier pregnancies. IEEE 2015; 103: 179–191.
8. Moreira MWL, Rodrigues JJPC, Oliveira AMB, " Smart mobile system for pregnancy care using body sensors.", International Conference on Selected Topics in Mobile and Wireless Networking (MoWNeT), Cairo, Egypt, 11--13 April 2016. New York: IEEE.
9. L.K.Hema et al., "Design and development of' IoT based pulse oximeter", Int. Journal of Pure and Applied Mathematics, 119 (16), 1863-1868.

AUTHORS PROFILE

L.K.Hema is a Professor &HoD in the department of ECE. She acquired her Ph.D from ManonmaniamSundaranar University in the field of Wireless Sensor Network. Her research interest includes VLSI Design, Hardware security and sensor based systems. She is lfe member in ISTE and member of IEEE. Mail id: hemalk@avit.ac.in.

Mr.VelmuruganS,pursued his under graduation degree (B.E) in ECE stream from Aarupadai veedu Institute of tec His is inerested in carriying out projects relvant to societal benefit.He is a member of IEEE

Bollam Sai Kumar. is a final year UG student from ECE department of AarupadaiVeedu Institute of Technology, Vinayaka Mission's Research foundation. His research areas are embedded systems, Communication Engineering.` She actively take part in technical symposiums and conferences and extra-curricular activities.

Rohit sai K. is a final year UG student from the Department of Electronics and Communication Engineering, AarupadaiVeedu Institute of Technology. His area of interest in the academic domain are embedded systems, process control applications

Rohit sai K. is a final year UG student from the Department of Electronics and Communication Engineering, AarupadaiVeedu Institute of Technology. His area of interest in the academic domain are embedded systems, process control applications