Human Centered Design Process of Health Monitoring device under EPICS

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Abstract: This paper describes about the whole design process (human centred design process) of 'Health Monitoring device' under EPICS (engineering projects in community services). It was initialised in December 2016 by EPICS partnering with "YOUTH FOR SOCIAL WELFARE SOCIETY". The project is designed for our client Mr. Chikile Madhu babu, head of the organisation. "Health monitoring device" can help patients and elderly people to monitor their health condition. The people, who cannot go to hospitals or health camps, can use this device to check their health status. The device is capable of measuring blood pressure, ECG, pulse rate, body temperature and room temperature. It is portable, accurate and easy to use.

Keywords: Community Partner, Health, Patients, EPICS- design process.

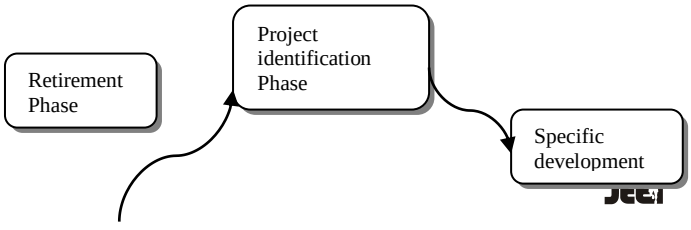
1. Introduction

Statistics shows that globally more than one billion people are living with high blood pressure and 17.7 million individuals are suffering from cardiovascular diseases. People with years of aches and pains lead to serious chronic diseases. Individuals being in poor health can have a long term influence on their educational and job opportunities. The following are the surveys done by previous researchers:[1] The paper titled "An Analysis of the Reflection Component in the EPICS Model of Service Learning" by William C. Oakes described about the Service learning which is a pedagogy providing a structured environment for students to link service with course learning objectives which in turn gives students the opportunity to examine their coursework in the context of the service they provide to their community and, in a broader sense, the impact they can have on the world. This paper presents an overview of the reflection activities that have been developed, interpretations of student reflections from these activities, and plans to evolve the reflection component in EPICS. [2] Another paper titled, "How Service-Learning Affects Students" by M.Astin showed the comparative effects of service learning and community service on the cognitive and affective development of college undergraduates. The goal of this paper is to enhance o understanding of how learning is enhanced by service. These questions were explored by means of a quantitative longitudinal study of a national sample of students at diverse colleges and universities and a qualitative study of students and faculty who participated in service learning at a subset of these institutions. [3] In the paper titled "**Android Based Health monitoring system**" by Mahesh londhe heart beat and temperature sensors to measure health condition the patient and guide him/her for a treatment, and to help the user by providing a list of hospitals of nearest locations and by giving health tips according to the threshold values. He also provide the facility of smart-key voice recording as well as alarms. This system can handle multiple patients at a time. this design can send the vital data to administrator via SMS.the other components are Microcontroller board, Bluetooth, Transmitter and Receiver, Buzzer, Bluetooth API, Smart-key voice recording [3] Similarly, Eugene odhiambo, 2016 in his study paper of "**Patient monitoring system**" used temperature, heartbeat sensors, Gsm module and arduino. It measures heartbeat and body temperature, display it on LCD and send it to patients' phone. This paper deals with real time monitoring of health using PIC MICRO CONTROLLER and SENSORS. It focuses on measuring blood pressure, ECG, pulse rate, body temperature and room temperature.

2. Method Analysis

A. Team Members

We as a 'TEAM' of three members from third year studying B tech Electronics and Communication Engineering (ECE) in Hyderabad Institute of Technology and Management (HITAM) initiated the project by making "YOUTH FOR SOCIAL WELFARE SOCIETY" as our community partner. Our team went through the following design process of EPICS which consists seven phases.



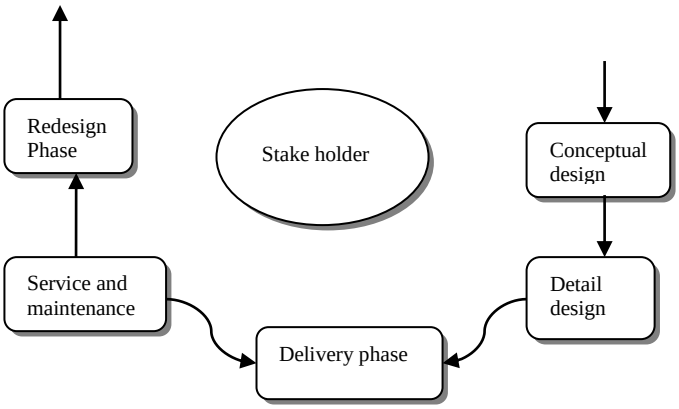


Fig1. Design process

B. Problem identification

In this stage, we met our community partner;

- Identified that they are facing difficulty in carrying multiple devices for different purposes while conducting health camps.
- The conventional type devices are neither portable nor handy to use.
- Even these devices are bulky. For instance, they use a bulky ECG machine to measure ECG and large sized BP device to measure blood pressure.

C. Specific Development

- In this phase, we went to community partner to discuss about the selected problem.
- They specified few more points which are needed to be included while designing our system.
- By considering those inputs, we searched for existing solutions if there is any device which is capable of measuring all these parameters.
- There are some existing solutions which not user friendly, cost efficient and portable.
- To cope up with these issues our team came up with some ideas by including the user specifications.

D. Conceptual Design

- Since the project was introduced, our team members brainstormed many concepts and created several sketches, prototypes.
- There are many concepts created before converging on our primary design. The original design was mainly conceptual consisting of B P SENSOR, ECG and TEMPERATURE SENSORS but individually.
- In the primary design we thought of combining above mentioned sensors using RASBERRY PI technology.

PRIMARY DESIGN

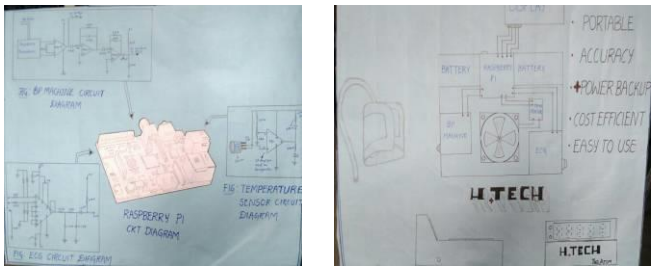


Fig 2. Sketches

PROTOTYPE

But later in the final prototype, we used BP, ECG and TEMPERATURE sensors with PIC 16F877A controller to enable more accuracy, portability, budget friendly and easy handling. The final product looks like the below prototype fig 3.

Fig 3

E. Detailed Design

After taking feedback from stakeholder, we started implemeting our device by gathering hardware consisting of above mentioned sensors, bluetooth and switch PIC controller and connected as per in fig 4 on a PCB (printed circuit board) fig 5.

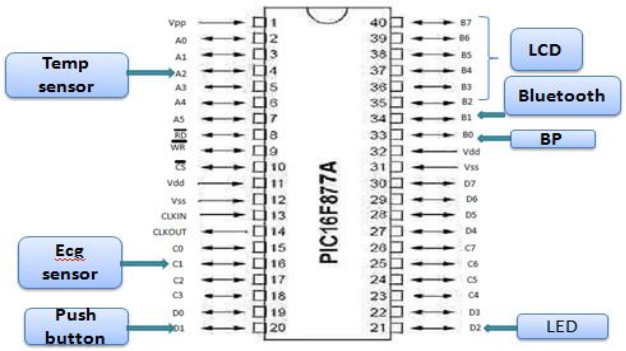


Fig 4. Connections to micro controller

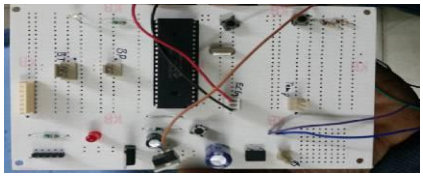


Fig 5. PCB

Hence in our device we are using various sensors to sense the physiological parameters like temperature, blood pressure and ECG. These sensed signals are transmitted to

pic16f877a microcontroller with the help of code written in embedded C by MP LAB X IDE software. The output is displayed on LCD.

Fig 6.Health monitoring device

The system has the following features

- Cost efficient- As we use low cost hardware.
- User-friendly- Easy to operate
- Accuracy-Digital Display
- Portable- Easy to carry

F. Delivery phase

We delivered the project to our community partner in the given time. He was very much satisfied with the device and also asked us to design some more devices of same type.

G. Service and maintenance

We hope to have provided health camps with a device that they can use to continue effectively providing care to the people. The volunteers at the organisation and health camps are going to maintain the project.

H. Retirement Phase

Although community partner has satisfied with the project, we want to make it look like the product.

3. Results

This frame work significantly comprises of three diagnostic tools like B.P machine, E.C.G, temperature sensors, LCD and PIC micro controller (16f877a), Bluetooth module. It is strong , reliable , super light weighted and ergonomically shaped medical diagnostic tool capable of measuring Blood pressure , E.C.G , Temperature, by using (B.P module ,E.C.G sensor, Temperature sensor) given as input to PIC micro controller and desired output is displayed on LCD using switches (1,2,3).

Table 1

S.No	Switches	function
1	Switch 1	Used to reset the circuit
2	Switch 2	Measures body temperature
3	Switch 3	Measures BP/ECG

Fig: Delivered and tested with community partner

Learning's from our project

- Estimating and scheduling task work, duration and costs.
- Worked on real time applications.
- Implementing risk management techniques during the process.
- How to develop options and actions to enhance opportunities. And reduce threats to project objectives.
- Being in a team environment, we gained knowledge in leading a project team and monitoring project progress.
- EPICS established a venue for capturing lessons learned and simultaneously we will be able to share our knowledge.
- We also acquired knowledge on applying best practices to plan a project.

4. Discussion

Health monitoring device is a user centered design process. Unlike other traditional methods to do a project, in EPICS we did it in a different way where the users need is considered as basic requirement. The main aim is instead of carrying multiple devices for different purposes they can carry this one device to monitor the patient's health. The devices which are currently in the market need particular knowledge about the device to operate them but this device is flexible and simple to operate.

5. Conclusion

Project was successfully made and delivered to the community partner. The objective of this project is to design a device to have effective, safe and personalized care at health camps as well as at home which has been successfully made. By exchanging one's ideas, sharing our views and implementing them is the best experience we got in EPICS. Service learning provides us the opportunities to use our skills and knowledge in real life situations of our community. Limitation of the project is that the weight of the device is more and it should look like product.

References

1. Lynne A. Slivovsky, Frank R. DeRego Jr., Carla B. Zoltowski, Leah H. Jamieson, and William C. Oakes, An Analysis of the Reflection Component in the EPICS Model of Service Learning at California Polytechnic State University/Purdue University.
2. M. Astin, L. J. Vogelgesang, E. K. Ikeda, and J. A. Yee, How Service-Learning Affects Students, Higher Education Research Institute, University of California Los Angeles, January, (2000).
3. Mahesh Londhe, Sandip Vandre, Atul Narote, Amol Nirmal, Sumit Khandelwal, "Android Based Health Monitoring System ",International Journal of Advance Foundation and Research in Computer (IJAFRC) Volume 2, Special Issue (NCRTIT 2015), January 2015.
4. http://www.academia.edu/24095308/PATIENT_MONITORING_SYSTEM_USING_GSM_AND_ARDUINO_ATMEGA