

DESIGN AND DEVELOPMENT OF A NOVEL BODY SENSING SYSTEM FOR CHILDHOOD OBESITY MANAGEMENT

Kavita Shyadligeri, Priyanka Peddinti, Shahriar Beizaee, Mojgan Dadashi

Faculty Advisor: Arun K. Datta*

National University Community Research Institute, National University, San Diego

MOTIVATION

- The preventive medicine at an early stage of child development has the potential of reducing, if not eliminating the possibility of developing chronic diseases that increase the cost of health care.
- There is need to address the childhood obesity and related chronic diseases.
- The Health Reform Act that has been signed into law-by President Obama in 2010 requires the implementation of EHR that has the potential to reduce the overall cost of health care.
- Strategies have been developed both at the State and Federal levels to identify the children at-risk/obese and place them in a wellness program with diet and exercise.

OBJECTIVE

- National University Community Research Institute (NUCRI) is engaged in developing CHOIS or Child Health and Obesity Informatics System as a health-IT solution to address the childhood obesity and related chronic diseases with a vision to offer it as a fully functional EHR supported by CI.
- The primary objective of this project is to design and develop a Bluetooth enabled novel Health Device with required multiple body sensors. Further development of mCHOIS for viewing real-time streaming body sensor data, using a Bluetooth enabled Smartphone and uploading and storing the sensor data to the existing remote CHOIS database, is anticipated.



Figure 1. overview of the proposed wireless healthcare system

BACKGROUND

- CHOIS, a web-based HPC supported distributed database system, has been developed using open source portal technology with three-tiered Open Grid Services Architecture
- Deployed for the School Health Program of the Illinois Department of Human Services (IDHS) after successful pilot testing. Its School Health Program monitors students health provided through 59 School-based Health Centers (SHCs) located throughout the State of Illinois

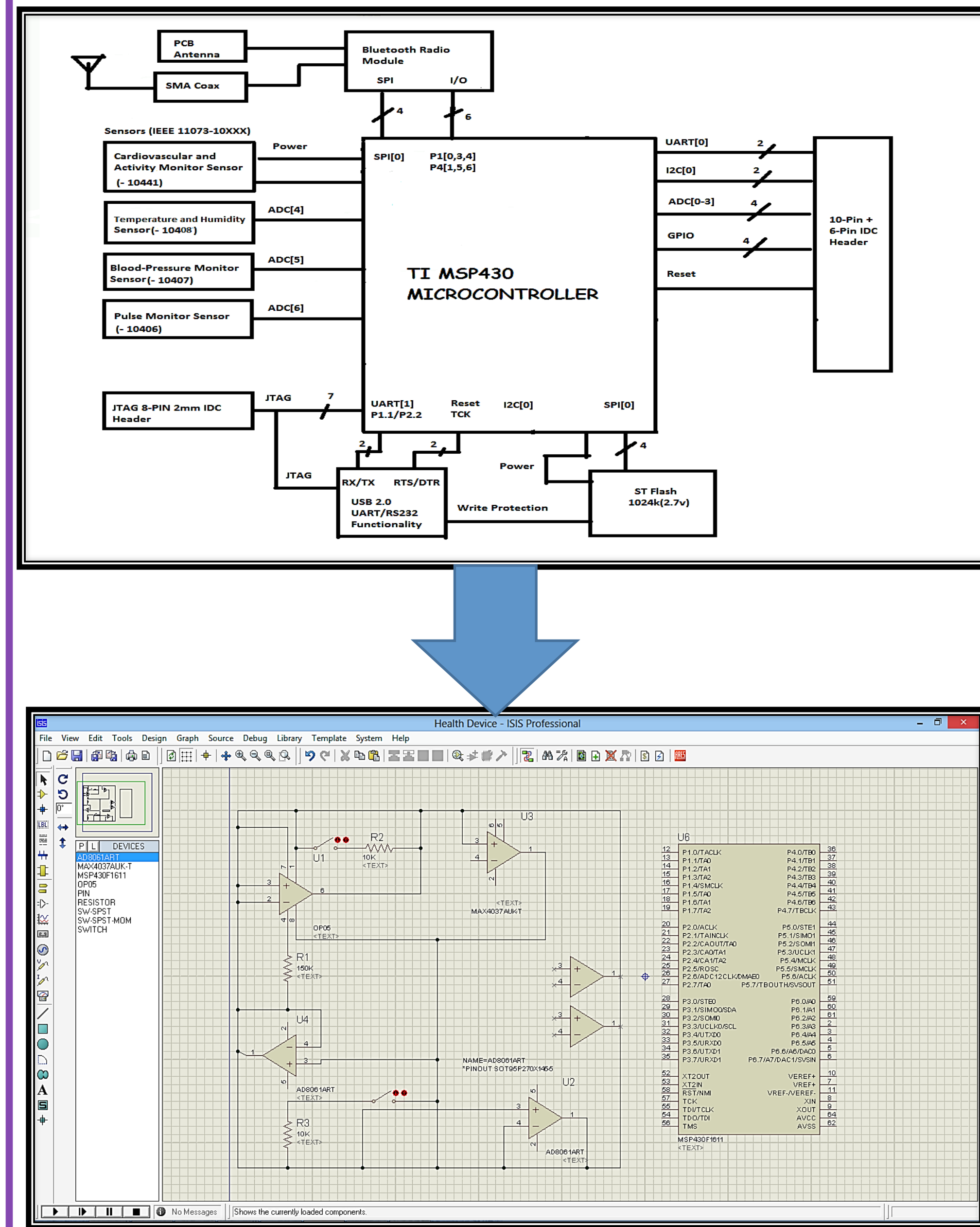


Figure 2. Proposed Hardware design and the Simulated View

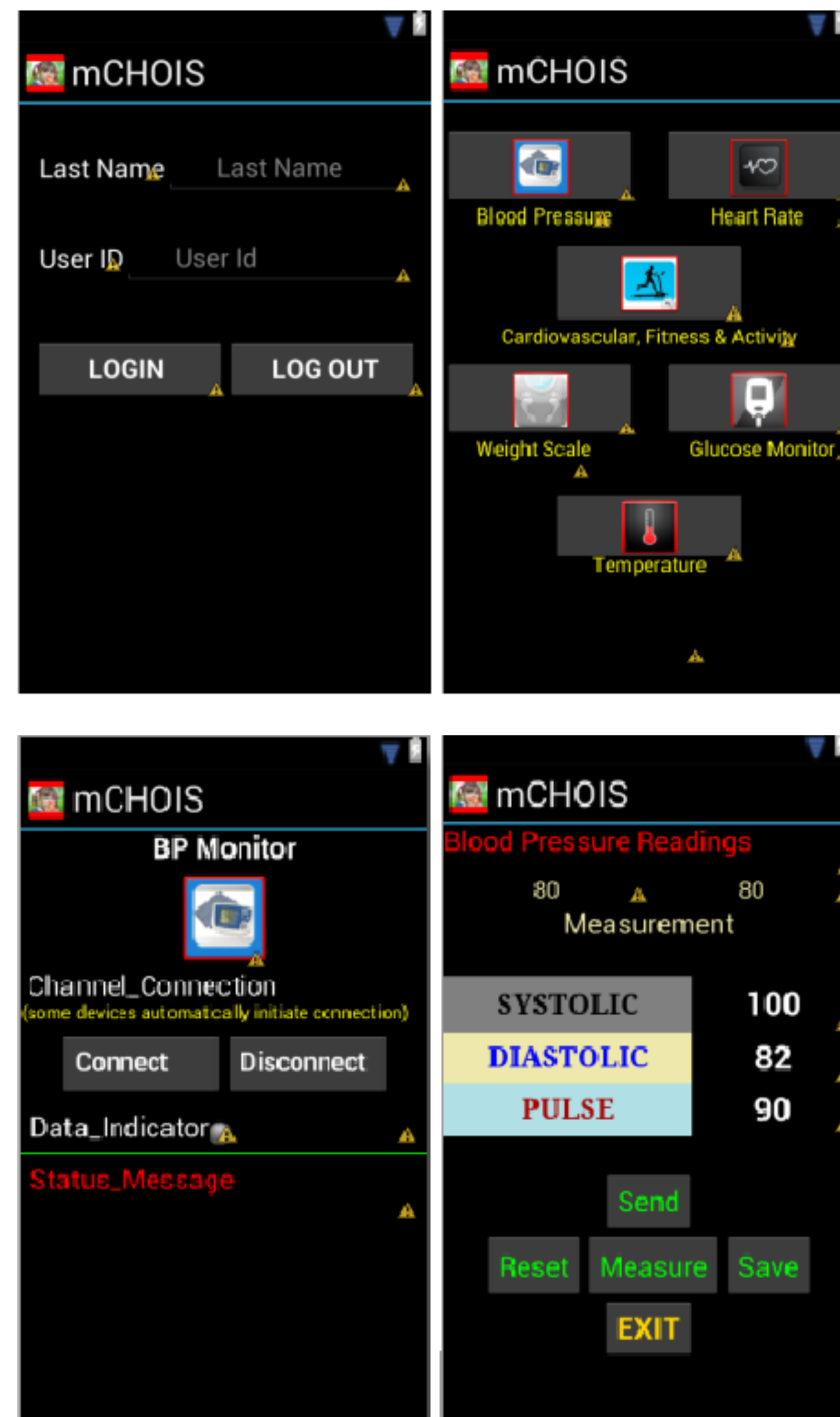


Figure 3. GUIs for Mobile Application (mCHOIS)

PROBLEM DESCRIPTION

- In 2010 alone, health related data from about 120,000 cases have been inserted into this CHOIS database that has become a valuable resource for research on childhood obesity.
- Childhood obesity has become a national concern in US. Strategies have been developed both at the State and Federal levels to identify the children at-risk/obese and place them in a wellness program with diet and exercise. However, tracking the progress is difficult. There is no effective tracking strategy to monitor the progress of this wellness program.

SOLUTION

- The proposed project is to design and develop a system consisting of both wearable sensor-based hardware and mobile-technology based software. In this solution, we will develop a WBAN that will collect sensor data (such as motion, pulse rate, etc.) and stream it in real-time to a smartphone through Bluetooth technology. The user will be able to view the sensor data in the smartphone after pairing (synchronization). A mobile application will be developed during this proposed project to view and save the data in the phone-based local database. These data can be sent to a remote server for further analysis using the technology that has been developed earlier.

- The major parts of the project are: Novel Body Sensors System , a smartphone and the Server database.

NOVEL BODY SENSING SYSTEM

- In our preliminary experiment, we developed a mobile application that can be used to view and store real-time streaming data from multiple health devices such as blood pressure monitor, cardiovascular fitness and activity monitor, pulse rate monitor etc.
- In developing the mobile application for this novel health device, we will further develop mCHOIS to view and capture real-time streaming physiological data including weight, and upload this data to the remote database of CHOIS. For weight monitoring we will use the Bluetooth enabled Continua-certified weight machine from the vendor (e.g., Omron).
- A “portlet”, termed ‘Healthy Choices’ has already been under development as a component of the portal, CHOIS. This portlet allows an individual to digitally record their physical activities and nutritional uptakes. Its web-based tools include BMI and BMR calculators, and Fitness tests. This system is also able to display a nutritional standard daily value based on a 2000 calorie diet.

- This web-based system has been developed with an objective of long-term data preservation, unified data access and sharing domain specific data amongst the scientific research collaborators of CHOIS project

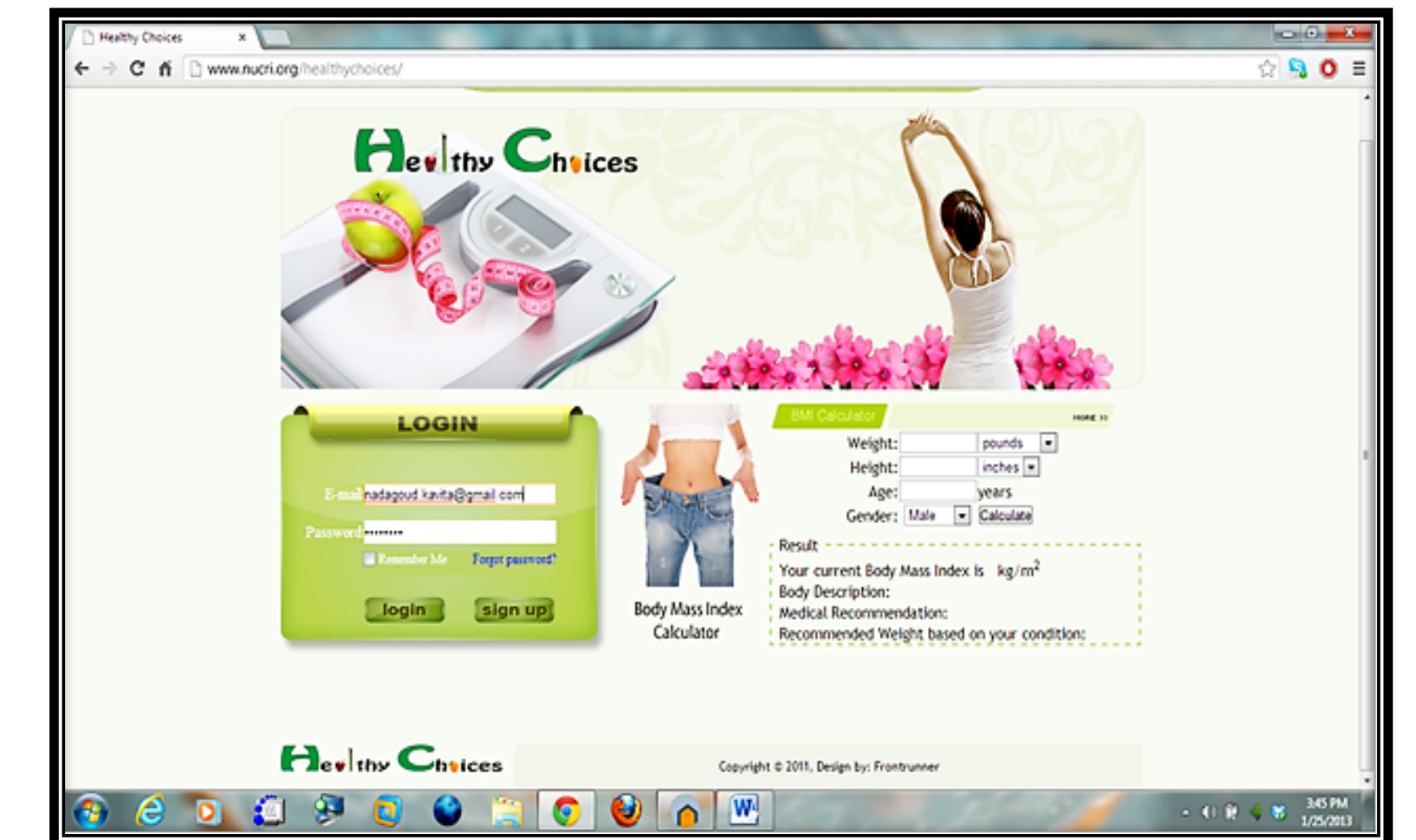


Figure 4. Portal interface for viewing collections in Healthy Choices

CONCLUSION

- The wearable device collects the body vital signs and communicates with the mCHOIS Android application which stores the data locally and also sends to the CHOIS database located remotely.
- Provides the collaborative data sharing of software and hardware for effective monitoring of a wellness program.
- Accessible at www.nucri.org/healthychoices/

FUTURE WORK

- The smartphone application can be made operating system independent.
- Further, the PCB design can be developed for fabrication which is more cost-effective, smaller in size and user friendly.

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REFERENCES

- CHOIS: Enabling grid technologies for obesity surveillance and control. A.K. Datta, V. Jackson, R. Nandkumar, J. Sproat, W. Zhu , H. Krahling. In ‘Healthgrid Applications and Core Technologies (Eds. , T. Solomonides, I. Blanquer, V. Breton, T. Glatard, and Y. Legre), vol 159, p191-202, IOS Press, Washington D.C. ISBN 978-1-60750-582.
- mCHOIS: An Application of Mobile Technology for Childhood Obesity Surveillance. A.K. Datta, A. Sumargo, V. Jackson, P. P. Dey (2011). Procedia Computer Science, vol. 5, p 653 - 660, 2011 (Elsevier).
- Cyberinfrastructure for Community Health Research. Arun K. Datta, Nitin Sukhija, Vineeth Jose, Bandhavi Nalajala (2012). 2012 Research and Scholarship Conference, National University, La Jolla (CA), September 4, 2012.

*For correspondence (adatta@nu.edu; Ph. 858 642 8535)