

INTRODUCTION:

This document describes and serves as a template for preparation of a Project Readiness Package. The objective of the Project Readiness Package is to document customer needs and expectations, project deliverables (including time frame), budget, and personnel / organizations affiliated with the project. It will serve as the primary source of information for students necessary during Phase 0 (Planning) to develop a SD I plan and schedule including specific deliverables and due dates. The Project Readiness Package will also support Faculty evaluation of project suitability in terms of depth, scope, and student / faculty resources by discipline.

In this document, italicized text provides explanatory information regarding the desired content of the sections indicated by non-italicized, bold, capitalized headings. If a particular aspect of a section is not applicable for a given project, it is only necessary to indicate that by entering N/A (not applicable).

ADMINISTRATIVE INFORMATION:

Information regarding contacts, budgets, facilities, resources, regulatory or legal considerations, proprietary or specialized components, technologies or intellectual property associated with the project.

- 1 Proposal Number:
- 2 Project Name: ***Remote Monitoring of EEG Signal Through Wireless Sensor/Rfid Networks***
- 3 Project Number:
- 4 Track:
- 5 Start Term: ***2007-1 (Fall of 2007)***
- 6 End Term: ***2007-2 (Winter of 2007)***
- 7 Faculty Mentor: ***Dr. Fei Hu (CE/KGCOE)***
- 8 Faculty Coordinator:
- 9 Customer organization and primary contact (name, phone, e-mail):
- 10 Project Overview (*1 Paragraph that provides a general description of the project in terms of background, motivation(s), customer(s), and overall objective(s).*):

Currently the US has large amount of elder patients with memory loss issues. It is very important to monitor those elders through automatic networking system.

An EEG Sensor System (ESS) is designed as a mobile system that is able to collect measured electroencephalograph (EEG, which monitors brain waves) data and to act according to instructions set by a doctor. The system consists of a body-monitoring network (see Figure 1). In order to recognize the monitored person's state, the monitor unit connects to EEG sensors and I/O devices using wireless communication technologies. Data from all EEG sensors is collected, stored and analyses in real time and, according to the analysis, actions may then be performed. A computer is used as an interface to the body-monitoring network, and developed software allows a doctor to configure the monitor unit for the monitored person, to connect EEG sensors and I/O devices, define and upload instructions for monitoring and download collected data.

The EEG monitor unit software consists of a communication module (responsible for connecting and controlling EEG sensors, and for gathering and pre-processing measured EEG data), a storage module (for storage of collected EEG data), and a policy interpretation module (responsible for controlling the behavior of the monitor unit according to instructions defined by a doctor).

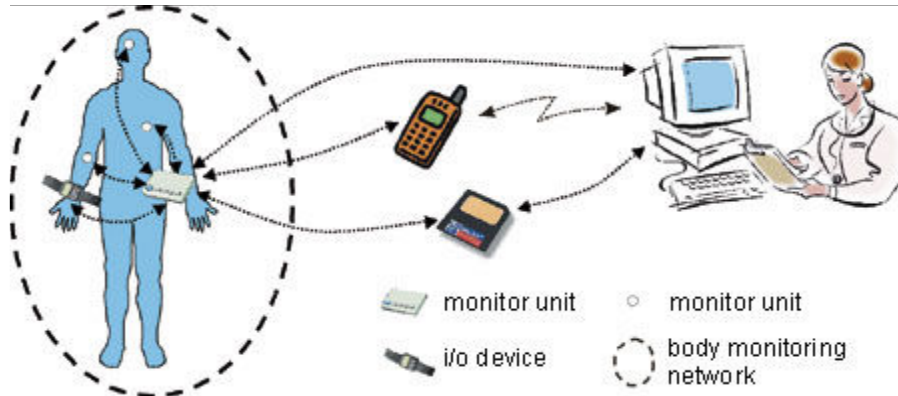


Figure 1: Overview of the EEG Monitoring System.

The overall objective of this multi-disciplinary project is to build EEG sensor hardware system with RF communication capability, and also design friendly EEG analysis software. Although this design will concentrate on monitoring the human body for medical purposes, the design of the body-monitoring System could also be used in many other fields (e.g. pulse rate monitoring in sports science, prevention of Sudden Infant Death Syndrome and monitoring of people working in dangerous environments).

11 Staffing Requirements:

Discipline (<i>number</i>)	Skills required (<i>concise</i>)
EE 2	Analog design, verification, testing skills
ME	
CE 2	Software and digital circuit design, network architecture design, testing skills
ISE	
Other	

- Continuation, Platform, or Building Block project information (*Include prior project number and title and to what extent previous results are being incorporated*):

This is a new design and no previous results are provided. However, Dr. Fei Hu will use his previous ECG sensor network results to speed up this project.

2 Principle sponsor or sponsoring organization:

Sponsor: Dr. Fei Hu - RIT CE Department.

His project & research in wireless health-care monitoring system are funded by a recent NSF grant where he is the PI.

DETAILED PROJECT DESCRIPTION:

1 Customer needs:

Wireless monitoring and analysis of EEG waveform for individuals, audio feedback

2 Customer deliverables (*Customer requested milestones, progress reports, and expected product*):

Milestones:

- 1) **Design of EEG active electrodes and amplifier**
- 2) **Sampling and processing of EEG waveforms**
- 3) **Interfacing processed waveforms with wireless architecture**
- 4) **Compiling results in basestation software**
- 5) **Producing feedback for users**

3 Customer and Sponsor Involvement (*Describe role of customer and sponsor in the project, planned participation in design and project reviews, etc.*):

Sponsor – Dr. Fei Hu and NSF will provide sponsorship of project, technical advice

4 Regulatory requirements (*i.e. UL, IEEE, FDA, FCC, RIT*):

FCC - wireless safety and standards

FDA - medical device safety

5 Project Budget and Special Procurement Processes (*Provide all budget details and processes associated with expenditures*):

EEG Hardware components and integration: ~ \$500.00

RF communication Hardware: ~\$400.00

6 Intellectual property (IP) considerations (*Describe any IP concerns or limitations associated with the project*):

Possible use of open-source software. See for example: <http://openeeg.sourceforge.net/doc/>

7 Other (*Describe potential benefits and liabilities, known project risks, etc.*):

Although this design will concentrate on monitoring the human body for medical purposes, the design of the body-monitoring System could also be used in many other fields (e.g. pulse rate monitoring in sports science, prevention of Sudden Infant Death Syndrome and monitoring of people working in dangerous environments).

DETAILED COURSE DELIVERABLES:

From the Course Deliverables document, extract general and discipline specific deliverables that are appropriate to the project. This should provide clear guidance to the students on what is expected.

- (1) EEG sensor hardware design***
- (2) EEG RF communication module design***
- (3) EEG signal processing software***
- (4) Wireless communication protocol software***

PRELIMINARY WORK BREAKDOWN:

Describe the anticipated distribution of general tasks to be accomplished by project participants based on perceived skill set requirements. This should justify the requested skills and number of students from each discipline.

This project needs around 2 CE students and 1 EE student for the following tasks:

The 2 CE students will design all wireless communication software and design RF boards. They will also investigate the EEG sensor components.

The 2 EE students will analyze the data acquisition circuitry requirements of the EEG signals. Responsible for design and implementation of relevant analog interface circuitry.

GRADING AND ASSESSMENT SCHEME:

Describe how the grading rubric relates to expectations and deliverables. The impact of project enhancements and improvements from baseline should be clearly articulated.

Grade “A” level: The EEG sensors can successfully collect brain data. The RF module can transmit the EEG data to a remote PC in real time through wireless protocols. The monitoring software is friendly. Multiple sensors can organize themselves into a multi-hop sensor network. The collected EEG data has less than 1/1000 errors.

Grade “B” level: All EEG sensors and RF boards work properly. The software can show the received EEG data.

Grade “C” level: EEG sensors work properly. The wireless part may not be able to transmit data for more than 100 feet. The software is not friendly.

Grade “D” level: The EEG sensor barely works. The RF board doesn’t work.

Grade “F” level: The EEG sensor doesn’t work.

THREE WEEK SDI SCHEDULE:

List expected activities in the first three weeks. Highlight any project specific activities that may not be part of the generic course syllabus (e.g. customer visits).

Week 1: Read lots of existing works on EEG monitoring and sensor design. Analyze the necessary design components.

Week 2: Read systematic wireless EEG system literature. Think of 2-quarter design plan.

Week 3: Discuss the EEG sensor design plan.

REQUIRED FACULTY / ENVIRONMENT / EQUIPMENT:

Describe resources necessary to support successful Development, Implementation and Utilization of the project. This would include specific faculty expertise for consulting, required laboratory space and equipment, outside services, customer facilities, etc. Indicate if required resources are available.

Category	Source	Description	Resource Available (mark with X)
Faculty			
	Dr. Fei Hu	He will provide EEG sensor design principle and wireless networking consulting.	X
	Dr. Dan Phillips	Information on EEG signal acquisition and instrumentation	X
Environment			
	Senior design space		X
	Board Molding tools		X
Equipment			
	EEG sensor components		
	RF boards		
	EEG monitoring software		
Materials			

Other			
	C/Java language tools		X
	Circuit design software		X