Progress Report
on a Controlled Home Assistive Device

TELEMEDIX Progress Report for a Controlled Home Assistive Device

Robin Mahony	Adrian Mocanu	Graham Holland	Vojta Prochazka	Rohit Thomas	Ravi Panchal
CEO	CFO	CTO	Secretary	Managing Director	Director of R&D

Contact Person: Robin Mahony
telemedix-440@sfu.ca

Submitted To : Dr. Andrew Rawicz-ENSC 440
Mike Sjoerdsma -ENSC 305
School of Engineering Science
Simon Fraser University

Issued Date: March 23, 2011

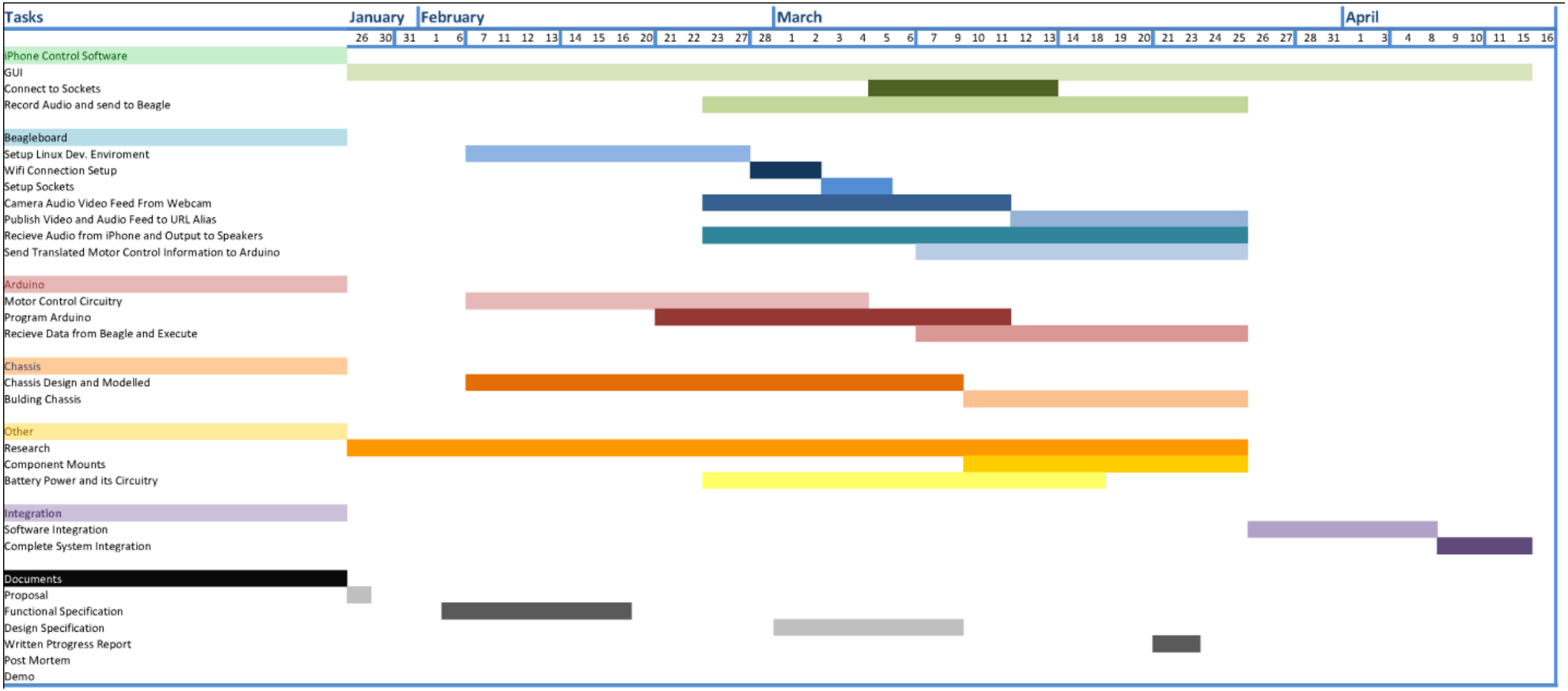
Introduction

Team Telemedix is working diligently to complete CHAD on time and on budget. Currently most of the sub systems are either partially or fully functioning. The project is on budget, but is slightly behind schedule. The deadline initially set for all separate components to be finished was March 25. This deadline will likely slip by one week, as there is still much to be completed with the BeagleBoard software, interfacing the BeagleBoard and Arduino and the chassis construction has yet to be started.

This report will outline the progress we have made in all the various areas of this project, including: the iPhone control software, the BeagleBoard software, the Arduino motor control circuitry and software, and the mechanical components of our robot, including the chassis.

On the following page is a Gantt Chart of our project deadlines. We have been attempting to keep up with the deadlines as best as possible.

Table 1: Gantt Chart of Project Deadlines



Subsystem Progress

1. iPhone Software Development

The iPhone software development has achieved several major milestones, and is on schedule with reference to Table 1. The application currently consists of the following: A main page is loaded on startup. Pressing the start button on this page causes the application to connect to a server (using IP and port number) and establishes a connection. This allows the application to send and receive data. Then a GUI is loaded that consists of two D-Pads (one each for the camera and movement of robot). Pressing a combination of these controls modifies a control string, and sends this control string to the server. Also, a video/audio feed is played, but this is currently set to play a sample video stored locally on the iPhone.

The following provides an outline of the status of the various milestones.

Milestones reached:

- Initial GUI developed including controls and control scheme (pressing control buttons correspond to modifying control string)
- Ability to stream audio/video feed from URL
- Socket connection established between iPhone and test server
- Socket connection established between iPhone and BeagleBoard

Milestones yet to be completed:

- Ability to record and send audio from iPhone
- Actually stream live video feed (dependent on BeagleBoard setting up a live feed)
- Refinement of control scheme involving establishing a communication protocol
- Further refinement of GUI including the ability to safely quit the application

The iPhone software development is making much progress, and will continue to be on schedule assuming that the BeagleBoard software development that some of the iPhone development is dependent on also remains on schedule.

2. BeagleBoard

The development of the BeagleBoard software has reached some of the major milestones and partially hit others, though is presently between one and two weeks behind schedule. This is largely due to issues in getting the development environment set up, in turn due to peripheral hardware problems. The development environment has now been setup and includes the Ubuntu 10.04 Linux distribution with Xfce desktop, text editing tools and the gcc compiler. The audio and video playback capabilities of the device have also been tested and are working adequately. The Belkin Wi-Fi adapter has been tested and used to provide Internet access to the device, though it still needs to be configured to automatically connect on start-up. We have also developed software for the BeagleBoard allowing it to receive data from the iPhone software. An outline of the status of the relevant milestones is shown below.

Milestones reached:

- Setup of the Linux development environment
- Wi-Fi connection setup (partial)
- Socket connection established between the BeagleBoard and the iPhone

Milestones yet to be completed:

- Obtaining audio and video feed from the webcam
- Publishing audio and video feed to a URL via a local webserver
- Receive audio from the iPhone and play through speakers
- Establish serial connection to the Arduino using I^2C

The BeagleBoard development team will be working hard in the coming weeks to bring this aspect of the project to being within one week overdue of the deadlines listed in Table 1. Audio receiving and playback capabilities are partially dependent on the iPhone software's ability to stream audio. However this portion of the BeagleBoard software will be developed in parallel with the iPhone software as much as possible to speed completion time.

3. Robot Motion

a. Electronics

The electronics controlling the motion of the robot have been successfully completed and tested. The drive motors of the device have been controlled using a custom designed circuit, and the pan tilt servo motors are controlled simply by the Arduino. To allow communication between the BeagleBoard and the Arduino, additional circuitry is needed in order match the voltages of the serial communication pins of the two boards. These circuit components have been ordered and are expected to arrive this week. All electronic systems, including the BeagleBoard, Arduino and custom circuitry must still be integrated with the battery packs, which are also expected to arrive this week.

Milestones reached:

- Designed motor controlling circuit and tested this circuit using lab equipment
- Tested custom circuit with wheelchair motors
- Integrated custom circuit with Arduino board

Milestones yet to be completed:

- Integrate electrical component systems with battery packs
- Electrical integration between BeagleBoard and Arduino
- Mounting systems and integration using proper electrical connectors
- Testing of integrated subsystem

b. Arduino

The Arduino controlling software has been written and tested with the electronics and pan tilt camera system. The Arduino was connected to a laptop via USB, and commands sent from the laptop controlled the pan tilt servo motors and wheelchair motors as expected. The Arduino must still be integrated with its battery pack, and has yet to interface with the BeagleBoard using a serial connection.

Milestones reached:

- Established USB communication with laptop for testing purposes
- Can control pan tilt camera system
- Can control device motors

Milestones yet to be completed:

- Interfacing with the BeagleBoard using I^2C.

Significant progress has been made regarding the motion of the robotic device. The Arduino software and electronics have been completed, as well as the integration between them.

They have been successfully tested with the drive and pan-tilt motors, and need only to be integrated with the BeagleBoard and portable power supplies. Looking at Table 1, the design of the motor controlling circuit and programming of the Arduino are on schedule. Integrating the systems with the proper power supplies is a week behind schedule, as is interfacing between the BeagleBoard and Arduino. Establishing communication between the two will be delayed slightly longer than expected, as we are waiting for additional circuit components to connect the two boards.

4. Mechanical

The overall framework and structural design is being followed according to the Design Specifications and has made progress in several aspects. The wheelchair has had many of its extra components removed and now consists of only the required chassis and motor assembly. This provides a clean base to work from with much room for flexibility. The Lynxmotion pan-tilt kit has been successfully assembled and its range of motion has been verified. According to Table 1, the modeling should have been completed on March 9th, the original Design Specification deadline, followed by the start of physically building CHAD. Since this due date was extended to March 14th, construction is behind one week. This also includes the enclosure and mounting plates for the electronic components. These enclosures have been delayed until the portable battery packs arrive from shipment. The battery packs also change the physical dimensions of the electronic components; meaning a redesign of the enclosures is required.

Plan of action:

- All building material is being purchased and construction will begin immediately
    - Since the mechanical drawings have been outlined in great detail, construction should progress smoothly with minimal challenges
- Sheet metal must be obtained to cut out the camera's mounting plate and secure it to the Lynxmotion pan-tilt kit
- Once the battery packs arrive, the enclosure's priority will increase greatly as they are an important aspect for the system integration, which is scheduled for April 11th ,2011

The projected completion date for the mechanical aspects will be in the first week of April 2011.

Budget

Telemedix is currently under the initial budget of $1350. Development costs to date have accumulated to $982.38. All major components have been purchased, only non-essential items are expected to be bought in the future. Such expenses were predicted, and will be acquired using the contingency fund, which was included in the original budget estimate. The use of an old electric wheelchair saved money since motors and their power supplies did not need to be purchased. Overall, Telemedix is expecting to meet the specified budget, and in the case that the project goes over budget, team members will contribute equally to additional costs.

Conclusion

Team Telemedix has made significant progress towards the completion of CHAD. Most of the sections are either on schedule, or will be back on schedule within the next few weeks. Many major milestones have been met, and there are only a few major milestones left before CHAD will be fully functioning. Also, the budget has been well adhered to and CHAD should be completed with a total cost close to or even under the initial estimate outlined in the project proposal. Team Telemedix will continue to work diligently and efficiently in order to complete CHAD under budget, on schedule, and in accordance with the design specification.

TELEMEDIX

TELEMEDIX
Simon Fraser University,
8888 University Dr.
Burnaby, BC Canada
Email: telemedix-440@sfu.ca