

Autonomous Wheelchair Development

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EPSCoR

Project Goals and Motivation

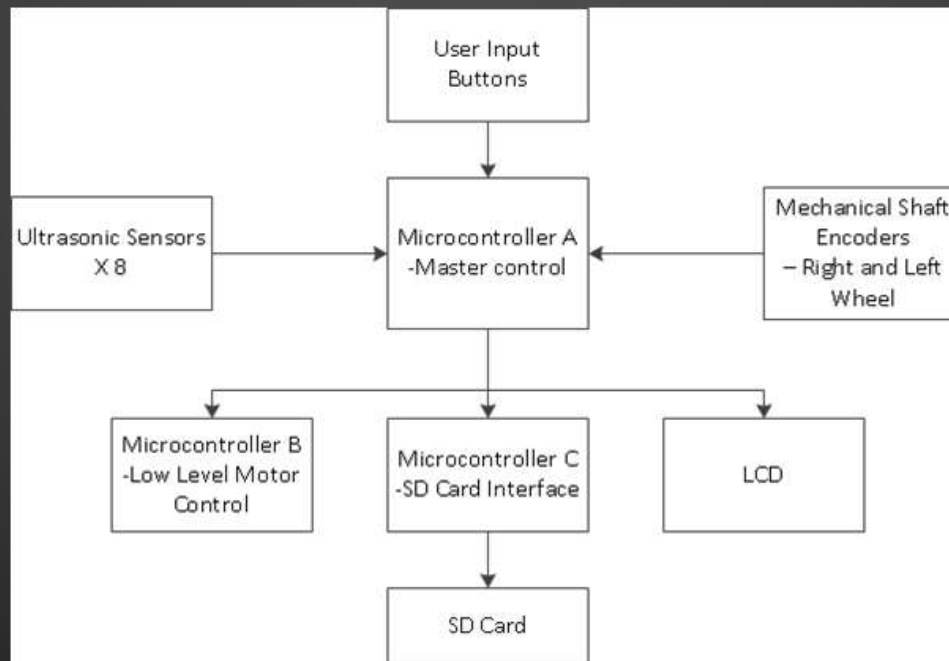
- Severe Handicaps
 - Mental
 - Physical
- Low Cost
 - 30% Below Current Entry Level
- Autonomous Functionality
 - Safety
 - Reliability
 - Flexibility

Past Research

- Feasibility Study
 - Using a microcontroller for motor control system
- Investigation of Existing Autonomous Wheelchairs
- Motor Control System Design
- Year One Development

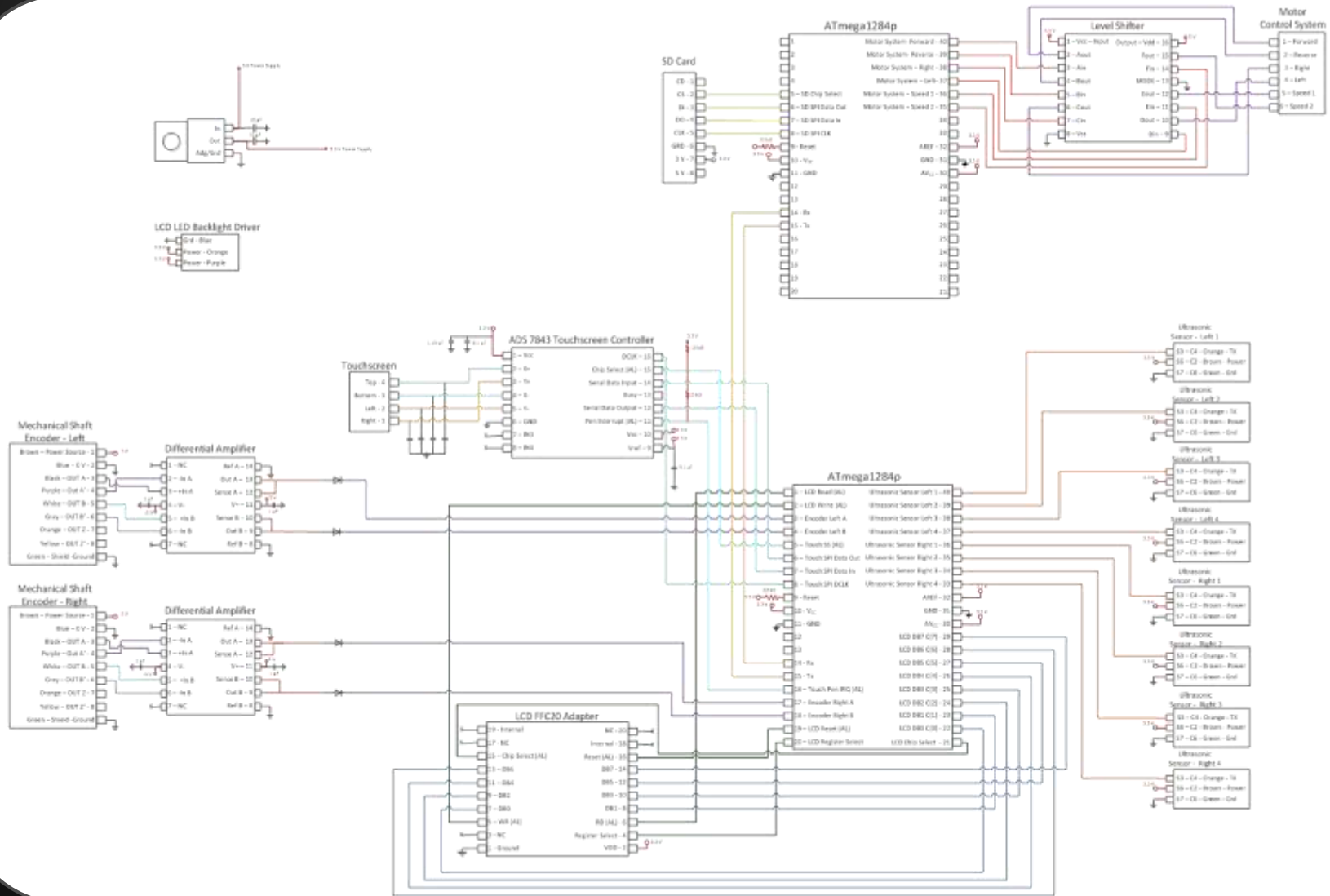
Initial State of Project

- Previous Work
 - Dr. Steven Barrett
 - Wheelchair Interface
 - Control System
 - Schultz and Shea
 - Sensor System



Initial Design Overview

Source: Schultz Shea- Final Report



Initial Development Goals

1. User Interface Creation

- a. LCD Display
- b. Touch Screen
- c. Graphical Design

2. Inter-Chip Communication Protocol

- a. USART

3. Motor Control to Control System Interface

4. Sensor Information Integration

- a. Ultrasound
- b. Encoder

5. SD Card Interface Creation

Objective #1: User Interface Creation

- LCD Display
 - Communication
 - Basic Display Commands
 - Text Driver System
- Touchscreen
 - No Communication
 - Wiring Issues
 - Electrical Interference



LCD Used To Display Touchscreen Data
Discovered Force "Drift" and "Double Tap"
No Solutions Were Found

Objective #2: Interchip Communication

- USART
- Issues
 - "Blind" Debugging
 - Damaged Chips
 - Intermittent Issues
- Solutions
 - LED Debug Display
 - Replaced Chips
 - Implemented Synchronous USART
- Full Functionality Achieved

Objective #3: Motor Control to Control System Interface

- Custom Parallel Protocol
- Safety Procedures
- Voltage Shifter

-Discovered "Shifter Freeze Issue"

-Full Functionality Achieved

Roadblock: Efficiency of Development

- Memory Issues
- Cumbersome Development Environment
- Electrical Issues
- Lack of Sensor Data

Solution: New Control System Required
-Objectives 4-6 Never Completed

New Control System Design

- Microcomputer vs. Microcontroller

Multiple Microcomputer Options

- Raspberry PI
- TI Launchpad
- BeagleBone

BeagleBone- Best option for project

- 700 Mhz > 8 Mhz
- 32 Bit > 8 Bit
- Linux
- Single Board vs. Chip Network

New Sensor System Selection

Options Considered:

- LiDAR
- Stereo Vision
- Kinect

Kinect

- 480x640 RGB-D
- 1-3 mm Resolution
- 30 cm to 10 m Range
- USB



New Project Objectives:

1. Electrical Integration of Beaglebone
2. Interface Beaglebone with Kinect
3. Graphical Interface for Beaglebone



