Progress Report II

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Product Rationalization

DC Motors

We are going to use 2 DC Servo Motors to carry human being with the wheel chair and the additional supplementation. The weight on the wheel chair will be shared by the 2 DC Servo Motors. We are planning to use a wheel chair with the weight no more than 20 kgs, due to the fact that it can be portable. Additional weights, such as batteries, DC Motors etc., will take no more than 30 kgs. Ultimately we are planning to carry a human being having no more than 100 kgs. If we sum it up, we are planning to carry 150 kgs with 2 DC Servo Motors. This weight will be shared by 2 DC Servo Motors, thus we can split it up. Each DC Motor should carry at least 75kgs. Power is equal to either torque multiplied by angular velocity or force multiplied by velocity.

$$P = F \times v$$

SInce the human being on th wheel chair is fully paralzyed, it should be driven with a safe velocity and we thought 0,1 m/s will be enough for the person on it to move. 75 kgs equals, 750 N of force.

$$F = m \times g$$

$$P = F \times v$$
$$P = m \times g \times v$$
$$P = 75 \times 10 \times 0{,}1$$
$$P = 0.075 \text{ kW}$$

With the help of our calculations at least 2 x 0,075 kW DC Motors are enough to deal with this kind of load. However, for the sake of safety we are planning to use 2 x 0,1 kW DC Servo Motors to handle this job. We are planning to buy 2 x M543E Industrial DC Servo Motors. It has maximum output power of 0,094 kW and maximum peak torque of 1.44 nM. It will have a load current of 0.3 A.

Emergency Stop Button

- When it is pressed, there will be about 20 ms delay to be activated and stop the system working.
- To be activated it is needed to be pushed at least 11 ms.
- It needs 24 V DC voltage to work properly. The current that flows through the device will be 0,075 mA and anticipated power will be 1.7 W.

Power Supply On/Off Button

- When it is pressed, there will be about 25 ms delay to be activated and start the system working.
- To be activated it is needed to be pushed at least 10 ms.

Microprocessor (8051)

For 16 MHz Clock

- It will take 300 ns to read an input from the cameras.
- It will take 300 ns to send the output which is interpreted by microprocessor.
- It will take 250 ns to interpret the input.

For 33 MHz Clock

- It will take 90 ns to read an input from the cameras.
- It will take 90 ns to send the output which is interpreted by microprocessor.
- It will take 150 ns to interpret the input.

Voltage Regulator

- Our voltage regulators will work with %3 output accuracy.
- Dropout voltage will be about 800 mV with 250 mA output current.
- It will be working at most 35 ms delay.

IR B/W Bullet Camera

The bullet camera will wait 0.1 sec to take another photo. In addition to that it is planned that detecting the initial eye coodinates will take 0.4-1 second.

	B&W Bullet	B&W Bullet Pinhole
Model	XNiteBtBW	XNiteBtBWPin
Infrared Capable	None / 715nm/ 780nm/ 830nm / 850nm / 1000nm / XDP Optional	Yes
Image Sensor	1/3 CCD BW	1/3 CCD BW
Video Format	B/W EIA or CCIR	B/W EIA
Operating Voltage	DC 9V to 12V	DC 9V to 12V
Power Consumption	110 mA	110mA
Gamma	0.45	0.45
S/N Ratio	> 30db	>48dB
Sensitivity	1.0 Lux	0.1 Lux
Resolution	>420 TV Line Horizontal	> 420 TV Line Horizontal
Video Out	75 ohm, 1Vp-p Composite	75 ohm, 1Vp-p Composite
Operating Temperature	-10 C to +50 C	-10 C to +50 C
Focal Length	3.6mm	3.6mm
Field Of View Angle	Diagonal 92 degrees	Diagonal 92 degrees
Weight	90 Grams	100 Grams
Video Connector	BNC	BNC
Dimensions	20.7mm (diam) x 59mm (long)	24mm (diam) x 50mm (long)

EasyCAP DC60 - USB 2.0 Audio/video Creator Capture High-quality Analog Video

The device has the ability to real time converting.It can convert 100 frame per second. If there exist some frame shift, it is almost impossible for one to observe such a shifting since human eye can only catch 25 frame per second. Data will be send by USB cable. USB 2.0 send data 480 mbps, in other words, it is fast enough to prevent the time shifting between camera and mother board.

Simulations

Proteus Isis was used throughout the simulation process. In the simulation, our initial purpose is that while the button is pressed a LED's light will increase and if the button is not pressed the brightness remains the same. This is done by using 8051 microprocessor, a DAC0808 and some capacitors & resistors, an OPAMP and a LED. Unfortunately, we still cannot come together a proper idea of what we should use for the brain of the system, it can be either a digital signal processor card or a laptop. Due to this dilemma, we have used 8051 microcontroller as a mini brain in order to implement our idea for the simulation. During this process, we benefitted from our previous lecture labs and notes. As a result, we have succeeded in our desired about the circuit. When the button in the circuit is pressed once, there is an incremenatation of the value of P1 of 8051 and this leads an increase of current output of the DAC. By using current, we transform it to voltage and create a change in LED's brightness.

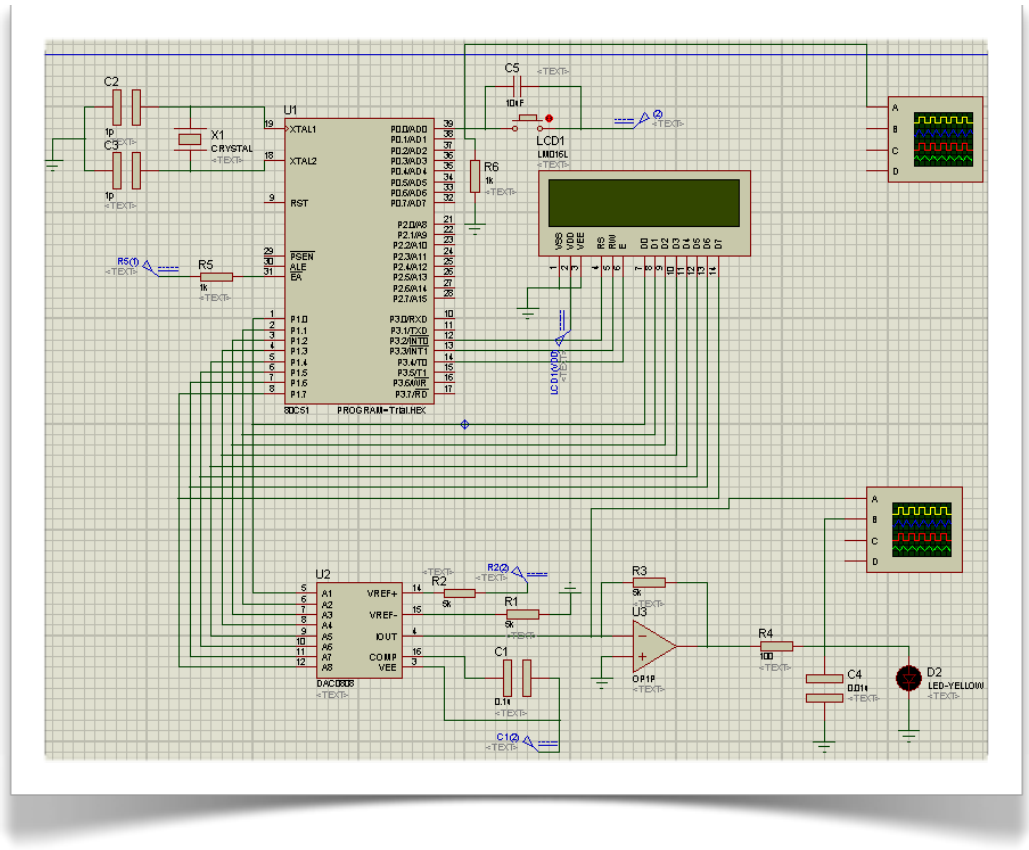

Figure 1. Before Simulation

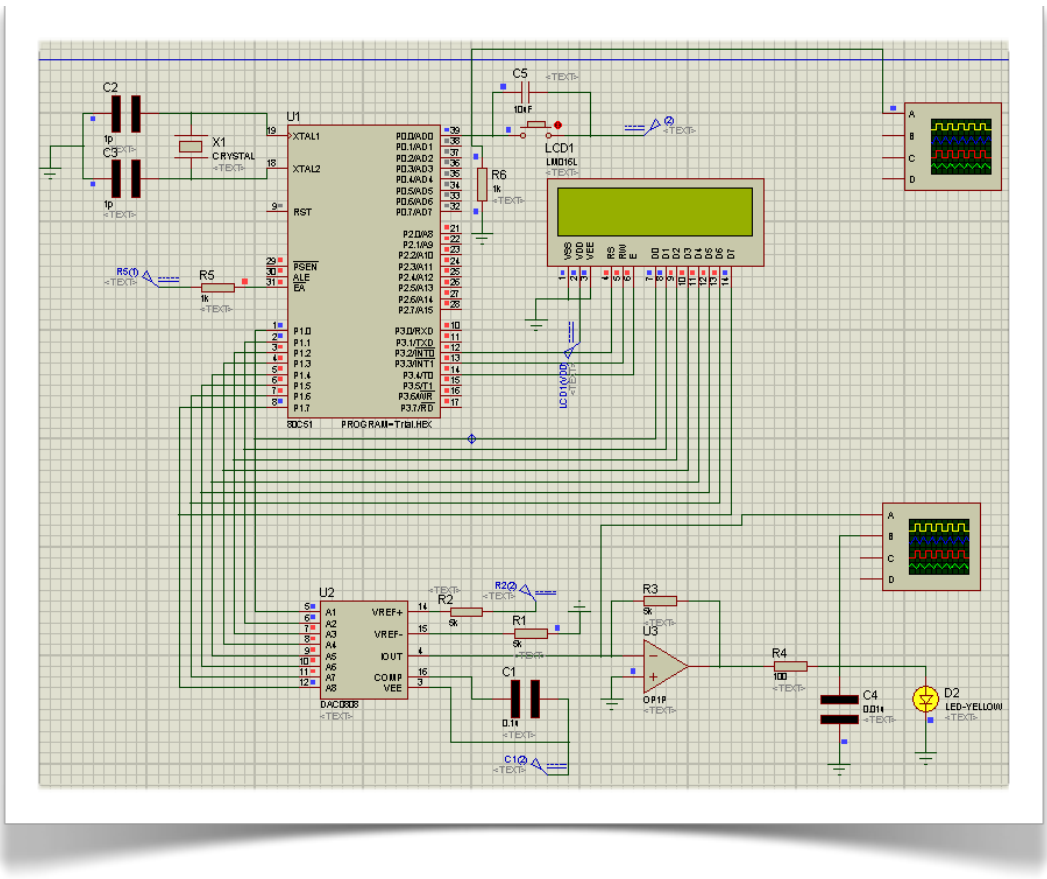

Figure 2. During Simulation

```
ORG 0H
SETB P0.0   ;INPUT port P0.0
CLR A
CLR P1            ;output port P1
MOV P1,#200 ;initially attain a
higher voltage value to observe
light change on LED

START:
MOV C,P0.0
JNC START   ;check carry if it is 1
or not (check button is pressed or
not)
CLR C       ;CLEAR C
MOV P1,A
INC A       ;
ACALL DELAY
SJMP START

DELAY:
MOV R0 , # 85H          ; delay is
500ms
HERE10:     MOV R1 , # 3H
HERE9:      MOV R2 , # 255H
HERE8:      DJNZ R2 , HERE8

DJNZ R1 , HERE9
DJNZ R0 , HERE10
RET
```

Figure 3. Assembly Code

Technology Demonstration Test Plan

In this project since the purpose is to move the chair based on the movements of pupil of eye that will be detected by camera and accordingly send data to microprocessor, electronic students' duty is to move motors on this purpose at the end of the semester. Thus, in interview three, our objective is to demonstrate that when up or down arrows are pressed from the keyboard, that are assumed to represent basically the eye movements, the adjusted LED is going to be turned on & off or its brightness is going to increase&decrease accordingly. For instance; if user presses up arrow meaning that in real life user wants to accelerate, in our circuit the LED that represents velocity will be turned on and afterwards if the button is still pressed its brightness will increase to show that the system can understand the detection of eye movements so that it send signal that implies the user wants to accelerate and in the completed version, this leads to an increase at the speed. When user presses down arrow, LED's brightness starts to decrease during the pressing period, in other words, user wants to slow down and looks down so this leads DC motors rotate slower and slower and eventually stop.

In our demonstration, we will show that we are able to take data which tell us to move forward, slow down or turn right/left. This data will be converted by 8051 microcontroller and give an output which determines the action that will be implemented next. Then, we will lead this output to the LED, which represents the DC motors, and depending on the action that will be implemented, LED will light up. By using the ports of 8051, we will make the connections between the microprocessor and circuit components. Here are the main test steps of our demonstration

I. Connect 8051 to computer.
II. Adjust Vcc to 5V and ground pin to ground. Check all the connections for convenience.
III. Load program to 8051.
IV. Turn on the circuit. LED should be turned of initially since there will not be any current passing through the LED as none of the arrow keys will be pressed. (We are not taking any data. The wheelchair is in steady state.).
V. Press up arrow key. The current will start to flow through the LED and it will start to light (In completed version this means, the user looks up in order to accelerate the wheelchair.). If we keep pressing the up arrow key, the voltage on this LED will increase which will cause its brightness to be much more visible (Pupils of the eyes are still looking at up. The wheelchair will keep accelerating).
VI. Press down key.The current flow will start to decrease through the LED and its brightness starts to decrease. (In completed version this means, the users looks down in order to slow down the wheelchair.). If we keep pressing the down arrow key, the voltage on this LED will decrease which will cause its brightness to be lower (Pupils of the eyes are still looking at down. The wheelchair will keep slowing down).

Conclusion

Our investigation continues rapidly. What we have achieved till this time is that we are on the right way on deciding how we are going to basically increase & decrease velocity of the DC motor, and turning the wheelchair right & left. Due to the fact that we have not bought DC motors and the main board yet, we have not got a chance to implement our thoughts; nevertheless by using 8051 microcontroller, we have an insight of the idea of how to practically apply our opinions.

There exist a major problem that we still cannot decide whether we should use a digital signal processor card or motherboard of a laptop or laptop itself as the brain of the system. This is because how the code part which is the main part of the system, that detects pupil motions and based on the pupil motions, it will send a signal and in regard of this signal, we are going to investigate it and DC motors gain movement accordingly.

Our major problem is selecting the brain of the system. We are on a steady state on this situation as we are waiting for a view of our CS colleague to understand what kind of device he is going to need for the best. We are of the opinion that since there is no main board, we try implement our thoughts basically by using 8051 by writing assembly code as we did for this report. 8051 is a useful microcontroller that lots of things can be implemented with, therefore we believe that we can achieve our purpose by utilizing from it.

Throughout our simulation we have achieved that when the button is pressed, LEDs brightness increase accordingly. Although it is hard to observe the change in LED's brightness since it happens really slow, in the end, the voltage generator part at the DAC iout pin will reach it's max value that is planned to be 5V and afterwards it will reset itself and start to count again. Throughout this process, LED's brigtness is increasing and when DAC reset itself, LED turn off and afterwards starts to be brighter in respect to voltage value.

References

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