Mechatronics Term Project- ME5643

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SMART TREADMILL

Project Goals

The project is motivated to make smart exercise equipment. That wont force the operator to use it according to treadmill settings. The following steps have been implemented

- Change the speed of the treadmill according to users motion
- Change elevation of the treadmill on button press
- Monitor operators positioning on treadmill track

Challenges to Overcome

- The structure should be light enough for the standard servo to raise and drop it off the floor
- The track material should be light, transparent from the center, should have appropriate friction to cause motion but not to stop motion of motor
- Keeping the standard components away from track area
- Not to overload Basic Stamp 2 Microcontroller

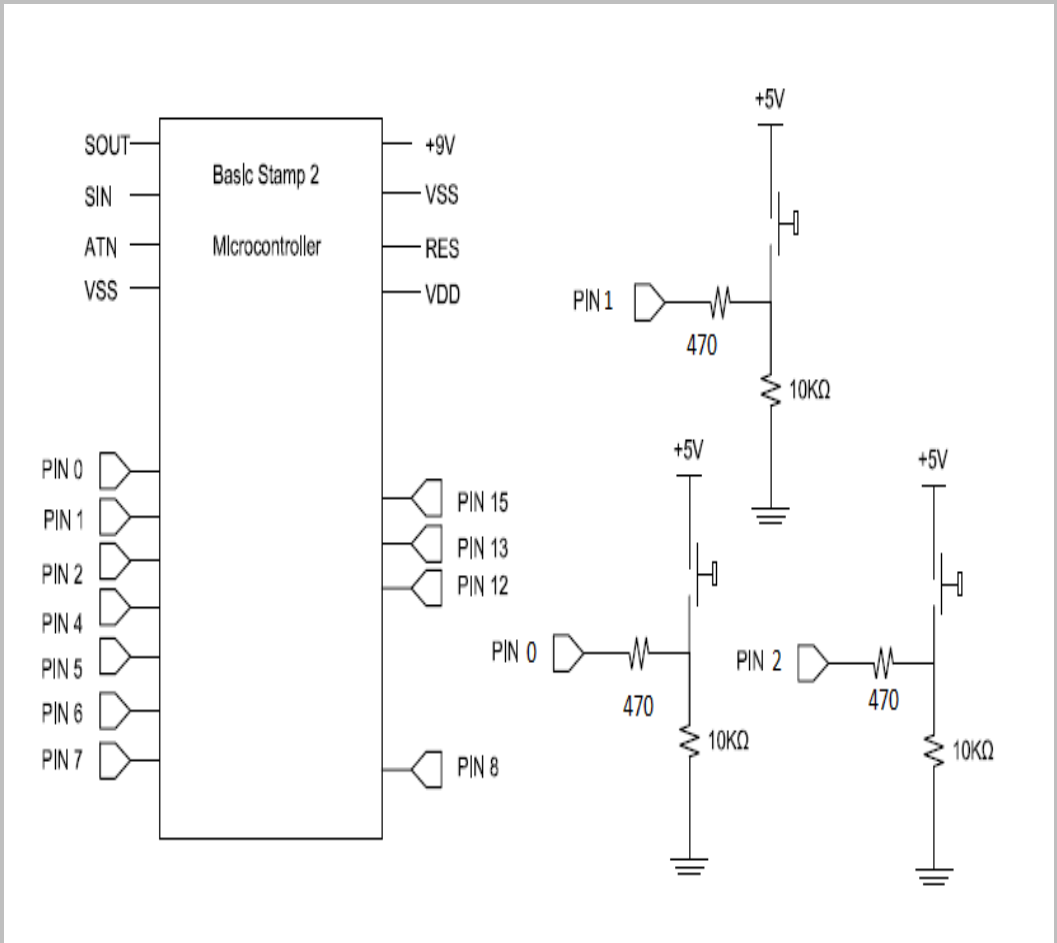
Construction

- Standard Components
- Boe-Bot Kit Components
- Parallax Standard Servo
- Photoresistors
- Resistors

Circuit types Used

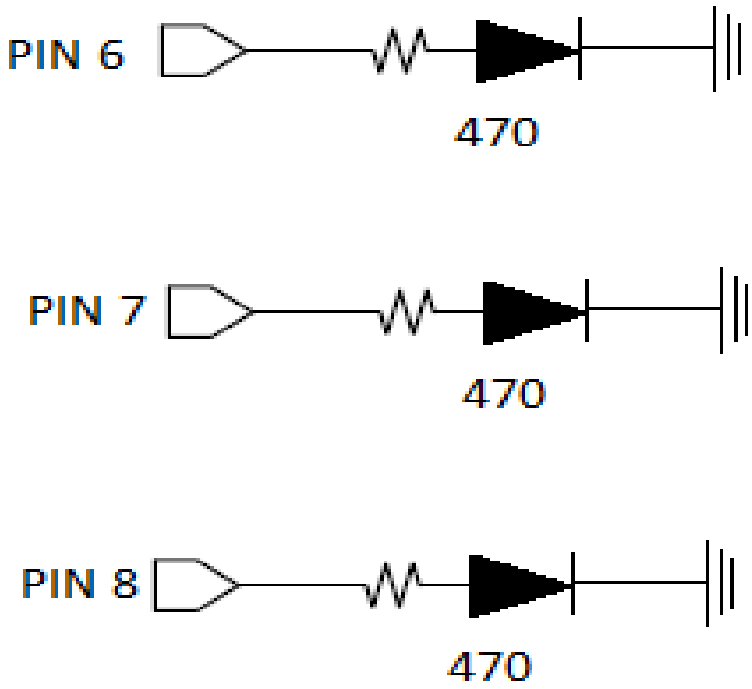
- RC Time circuit for monitoring photoresistors
- Push button circuit to monitor user input
- LED's to acceleration and speed of the treadmill
- Servomotors to control speed and elevation

Push buttons, PIN Connection.



PIN 0-
HIGH - turn system ON
HIGH - turn system OFF
PIN1 - Increase Elevation
PIN2 - Decrease Elevation

LED's Pin



LED's used:

Red, Green, Yellow

Display Types-

- Red Blinking –De accelerating
- Green Blinking- Accelerating
- Yellow Blinking- Constant Speed
- All LED's Blinking- Running at Top Speed

RC time for Photo resistors

RCTIME 3, 1, far

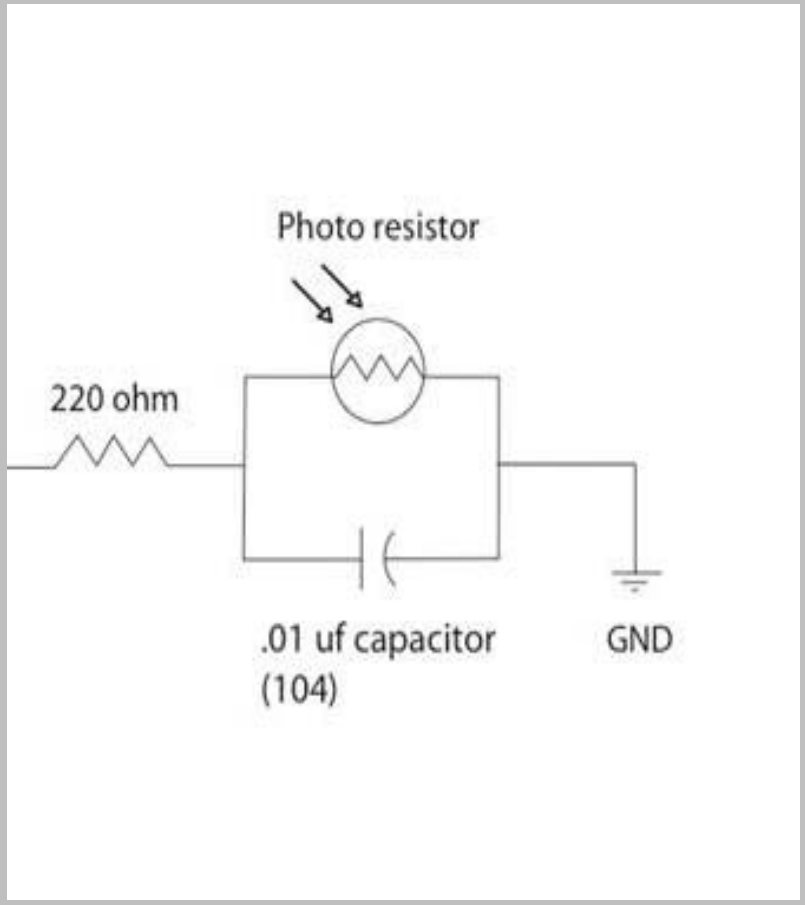
RCTIME 4, 1, center

RCTIME 5, 1, close

HIGH 3

HIGH 4

HIGH 5



Logic Used

Subroutines-

- Stopcheck ‘Check if stop button has been
- Elevationcheck ‘Adjust the height of treadmill
- Position ‘Subroutine to get position of runner
- Keepspeed treadmill ‘Subroutine to maintain speed of the
- Accelerate treadmill ‘Subroutine to accelerate the
- Deccelerate treadmill ‘Subroutine to decelerate the

Motion Control and Position Monitoring

Accelerate:

```
IF (center<far) THEN
counter = counter + 1
speed1=speed1+counter
speed2=speed2-counter
HIGH 8
ENDIF
RETURN
```

Constant Speed

```
IF (center>close) AND
(center>far) THEN
counter = 0
speed1=speed1
speed2=speed2
HIGH 7
ENDIF
RETURN
```

De-accelerate:

```
IF (center<close) THEN
counter = counter + 1
speed1 = speed1 - counter
speed2 = speed2 + counter
HIGH 6
ENDIF
RETURN
```

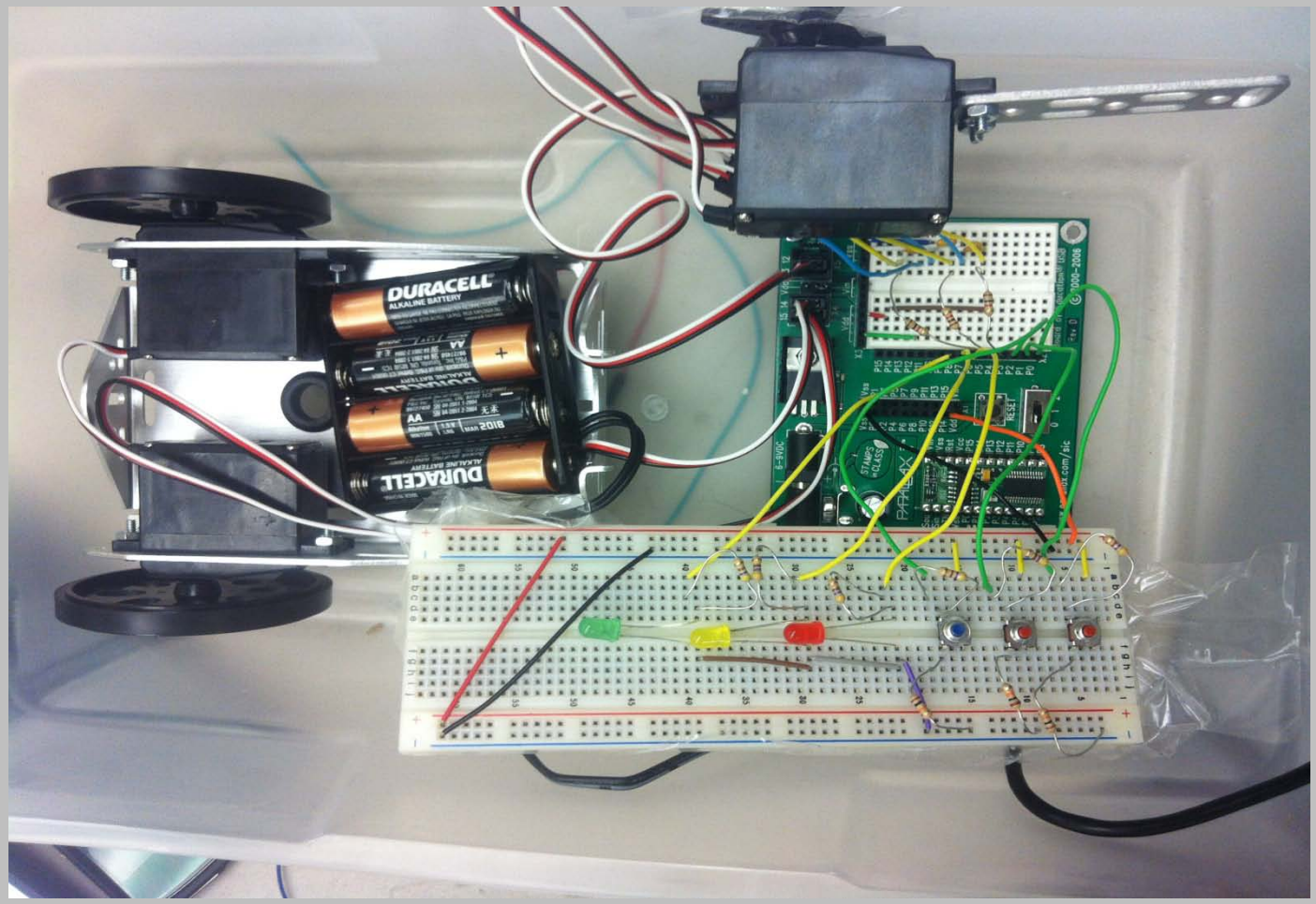
Elevation Control

```
IF IN1=1 THEN
elevation = elevation – 2                    (increase elevation)
ELSEIF IN2=1 THEN
elevation = elevation + 2                    (decrease elevation)
ENDIF
IF (elevation > 1050) THEN
elevation = 1050
ELSEIF (elevation < 600) THEN
elevation = 600
ENDIF
PULSOUT 13, elevation
RETURN
```

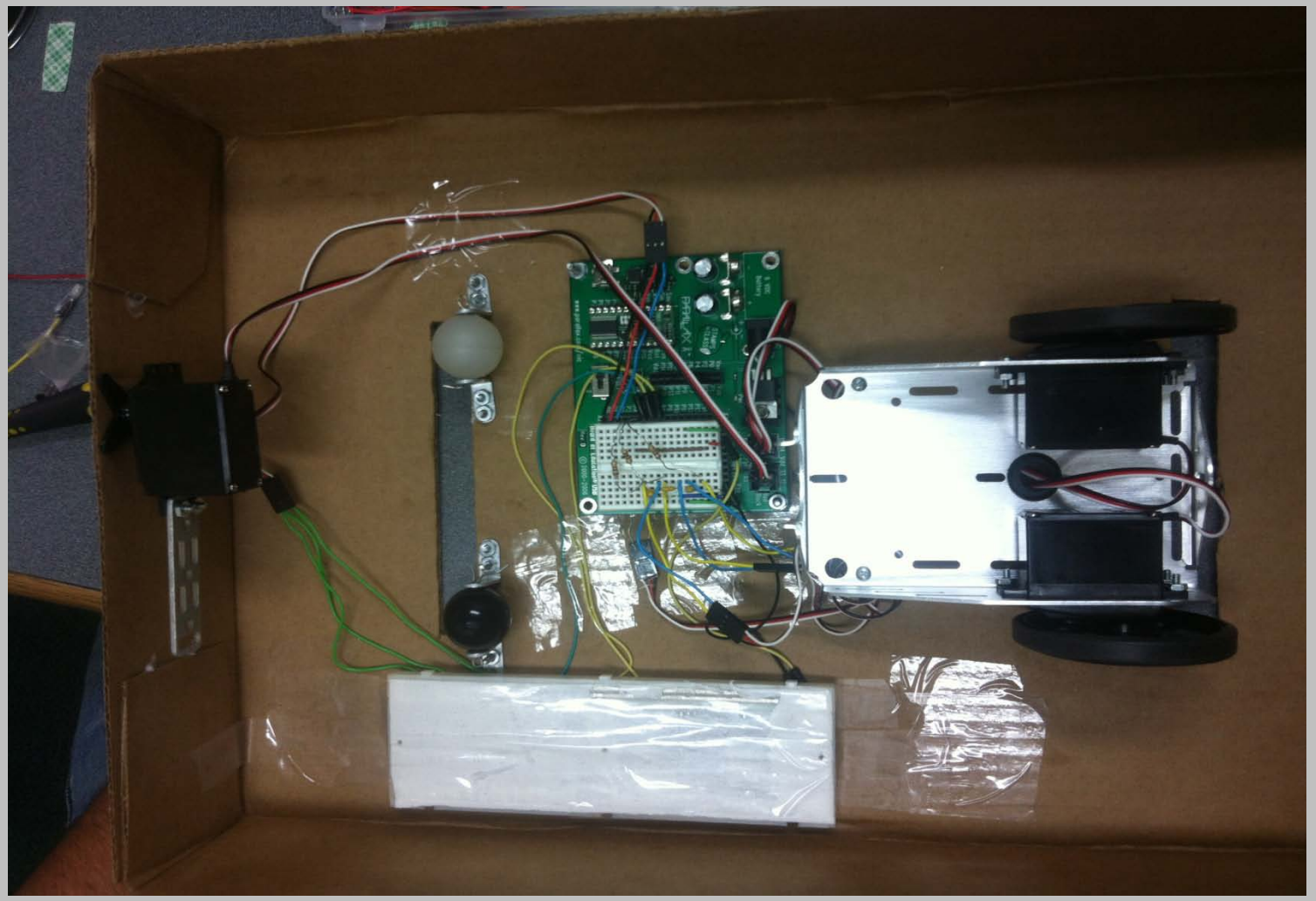
Working:

- Button Click turns on the motor
- Shadow caused by the users body on the front end of the track increases the speed and turns the track ON.
- Motion is controlled by users positioning which can be monitored by LED's
- Push buttons to control elevation of the Setup

Pictures: Old Setup



Pictures: New Setup



Problem Faced and Solution

- Loss of Friction on Track
- Loss of Elevation stability

Measures:

- Use of cardboard body, significantly reduces weight , allowing servo motor to function properly
- Use of paper ends on track increases friction as compared to clear film, also reduces heat

Cost Analysis

- Cost of prototype=$ 203.43
- Cost if Mass Produced= $ 155.7

- Savings=

  (203.243-155.7)/203.43*100=23.46%

Future Scopes

- Can be integrated with heart beat monitor and pressure sensor to provide accurate calories measurement
- A rubberized track made of light material can be used to replace track and body
- Integration of high speed dc motor and potentiometer to overcome

Questions??