E-Frog Game

Group 6

E. Astrid Cruz (EE)

Carlos Neyra (EE)

Jaime Salazar (EE)

UCF

Introduction E-Frog Game

- The Frog Game is a game that exists in a traditional wood version.
- It consists in a box table of: a bronze frog with its mouth open,
- 20 holes, and10 metal coins.
- A player stands 15 ft from the table and throws coins to the target (frog's mouth)

UCF

Introduction E-Frog Game

- Each hole has a corresponding value of points (2-7pts) based on location.
- Also, there are three flipping obstacles on the first row with value points of 10 -20.
- The maximum score is the

  the frog's mouth with

  40 points.

UCF

Motivation

- Today biggest cause of sickness and problems is the stress.
- In order to relax people enrolled in bad habits or addictions.
- Have fun during Senior Design.
- IDEA: Why don't we implement and create an electronic version of this fun game and make it easier to use and more attractive?

UCF

Goals

- The main purpose of this project is to improve the traditional game with an electronic version.
- Apply all the knowledge, hard work, and skills learned throughout the school years.
- The challenging part is to be able to create, design, and build a new fun product that has never been implemented to this scale before.

UCF

Goals

- Show concepts needed for an electronic game.
- Make it user friendly and easy to use.
- Simple and attractive design.
- Keep game score.
- Detection of coins through infrared technology.
- Smooth interaction of multiple inputs and outputs.

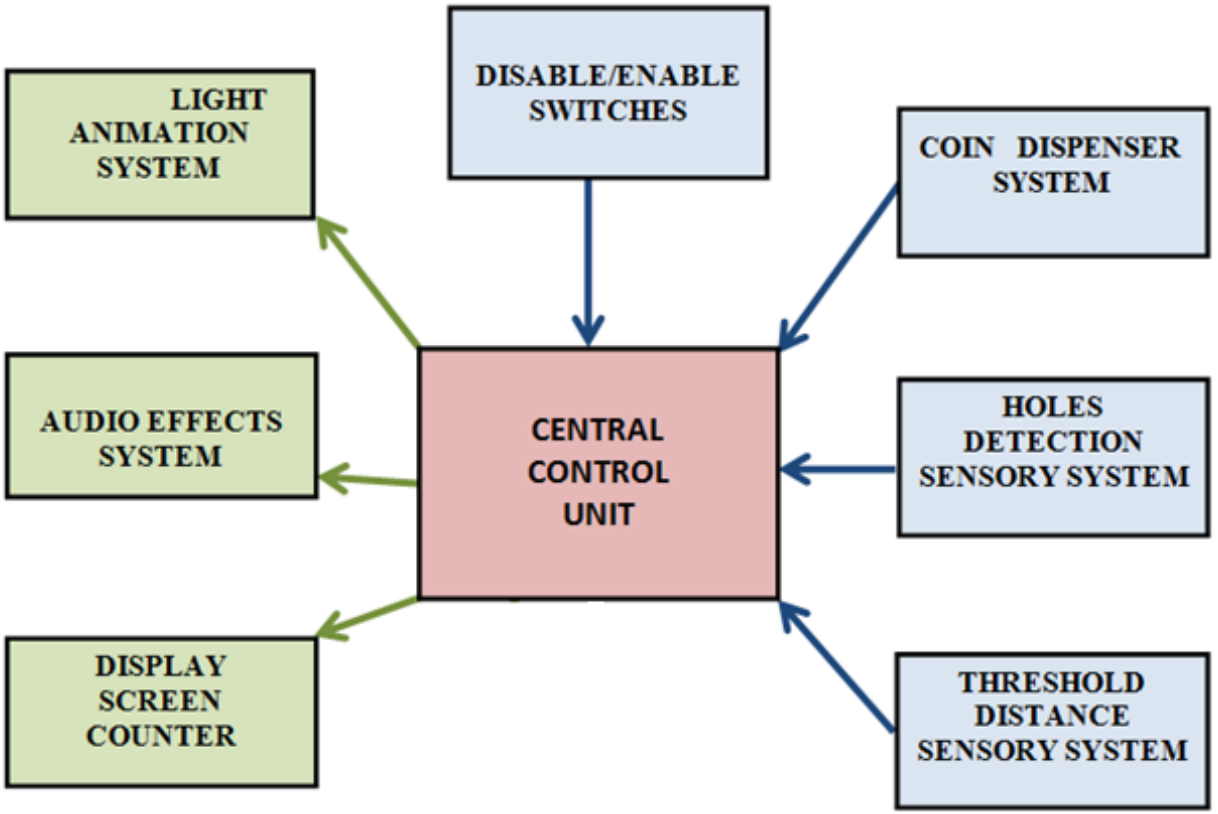
UCF

Innovation

- It is the first time a game like this is modified in an electronic way.
- Introduction to sounds, light systems, lasers, displays, and customized inputs to modify the operation of the game.
- Microcontroller that will take care of the counting of the points, control of the lights, and modulation of the sound.

UCF

Block Diagram



Objectives

- MCU objectives:
- Responsible for receiving and interpreting the data from the sensor units.
- Transfer of data to / from MCU and subsystems.
- Be the interface media for the programmer to configure it to the desired specifications and functions of the game.
- Control the interaction and developing of the game at all times.
- Communication with sub-systems.

UCF

ATMEGA 2560

Specifications:

- General purpose Input / Output pins: 86.
- 4KB EEPROM, 8KB internal SRAM.
- 32 general purpose registers
- Clock Speed: 0 - 16MHz @ 4.5V - 5.5V.
- High performance / Low power.
- Easy to use and possesses a rich online library.

UCF

Objectives

Display:

- Show updated points information in the display screen.
- Reflect total points per player at the end of each round.

UCF

Objectives

Sensors Objectives:

- Laser array with infrared phototransistor.
- Detect when a coin passes through the sensor array.
- Detect the hole coordinates by which the coin passes.
- Infrared Barrier in the coin dispenser.
- Sets minimum distance allowed for a player to throw a coin in the threshold sensor.
- Buzzer alerts a player when the line is crossed.

UCF

Objectives

LED System:

- Generate multiple light patterns directed through the microcontroller using the MAX7219 driver.
- Four different colors will be used as part of the lighting system(Blue, green, red, yellow).
- Each hole will light up as the coin passes through it.

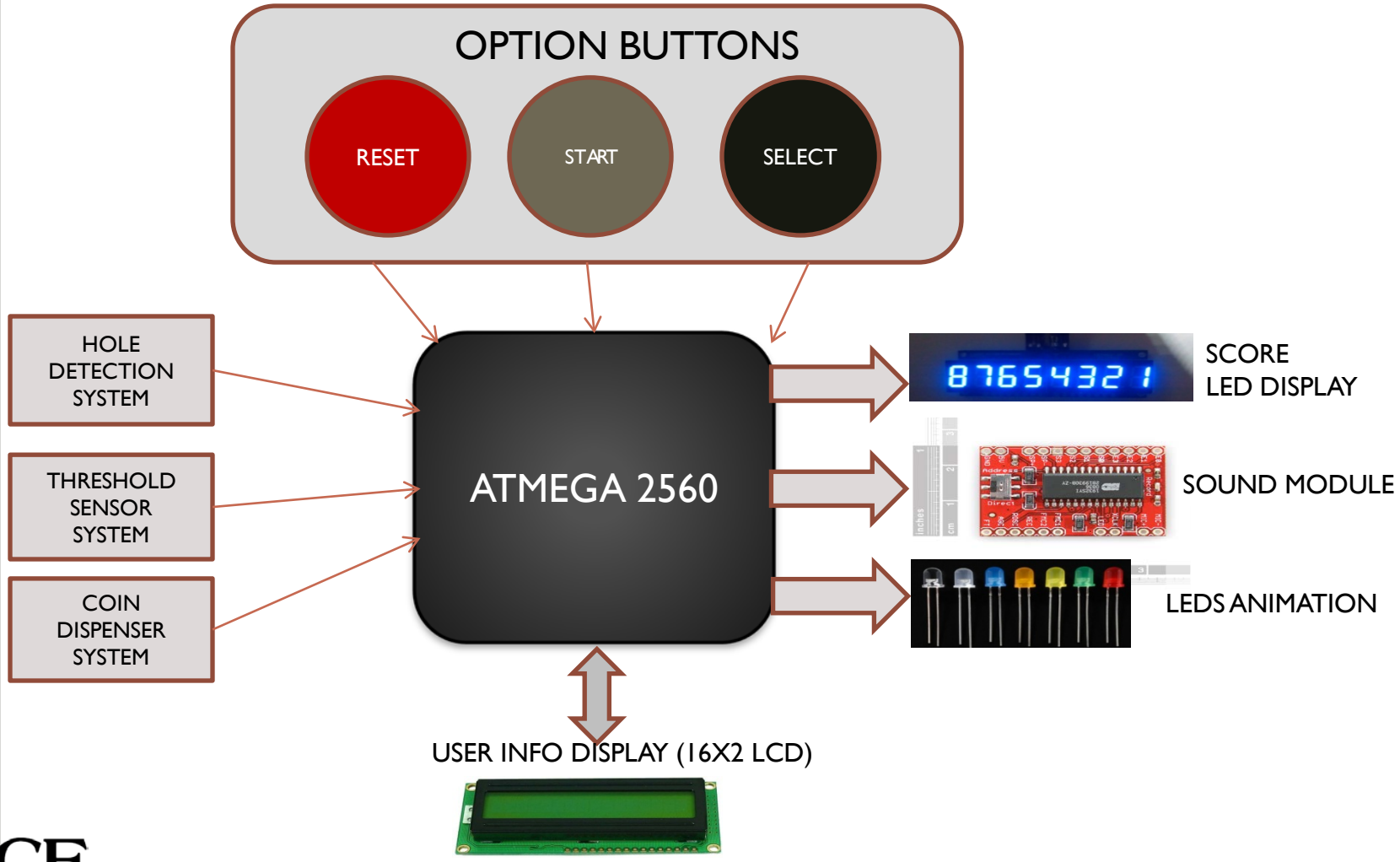
UCF

Requirements and Specifications

- Portable and ready to use.
- Box dimensions: 2'L by 2'W by 1'H.
- Maximum weight is thirty (30) pounds.
- Number of holes twenty (20) evenly spaced out.
- Ten (10) bronze coins.
- Operates on main power of 120V at 60Hz.

UCF

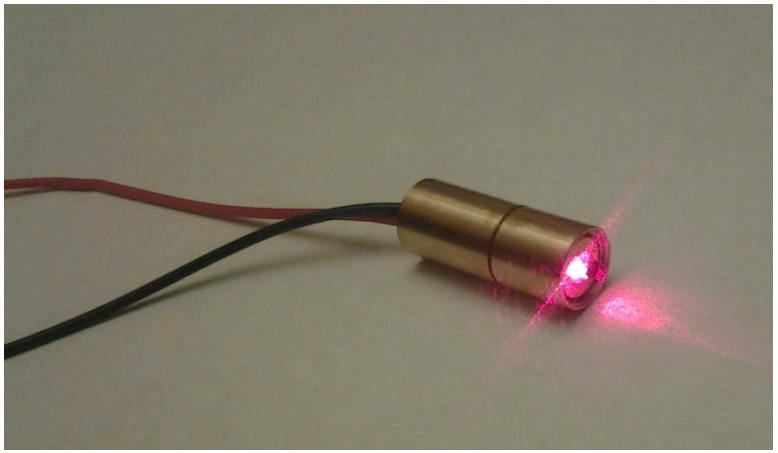
E-Frog Subsystems- Design Diagram



Hole Detection Sensor System

Laser Specifications:

- 650nm wavelength.
- 3.3 V DC operating voltage.
- Operating current <40mA.
- Life Span: 5000 hours.
- Output Power < 5mW.
- Focus Distance: 10m.
- Spot Size: < 10mm.



UCF

Hole Detection Sensor System

Laser Requirements:

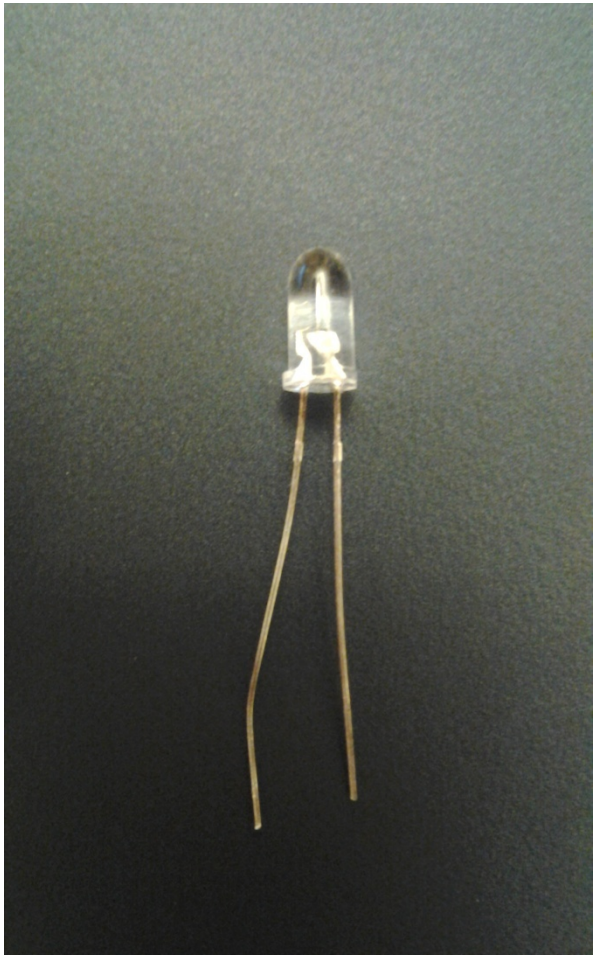
- Needs to be energized by a 3.3V source for steady infrared propagation.
- Voltage Regulator incorporated to the PCB design to run all the lasers in the game.
- Class IIIa laser, which means that a lot of care needs to be taken to avoid damage to retina.

UCF

Hole Detection Sensor System

Receiver Specifications:

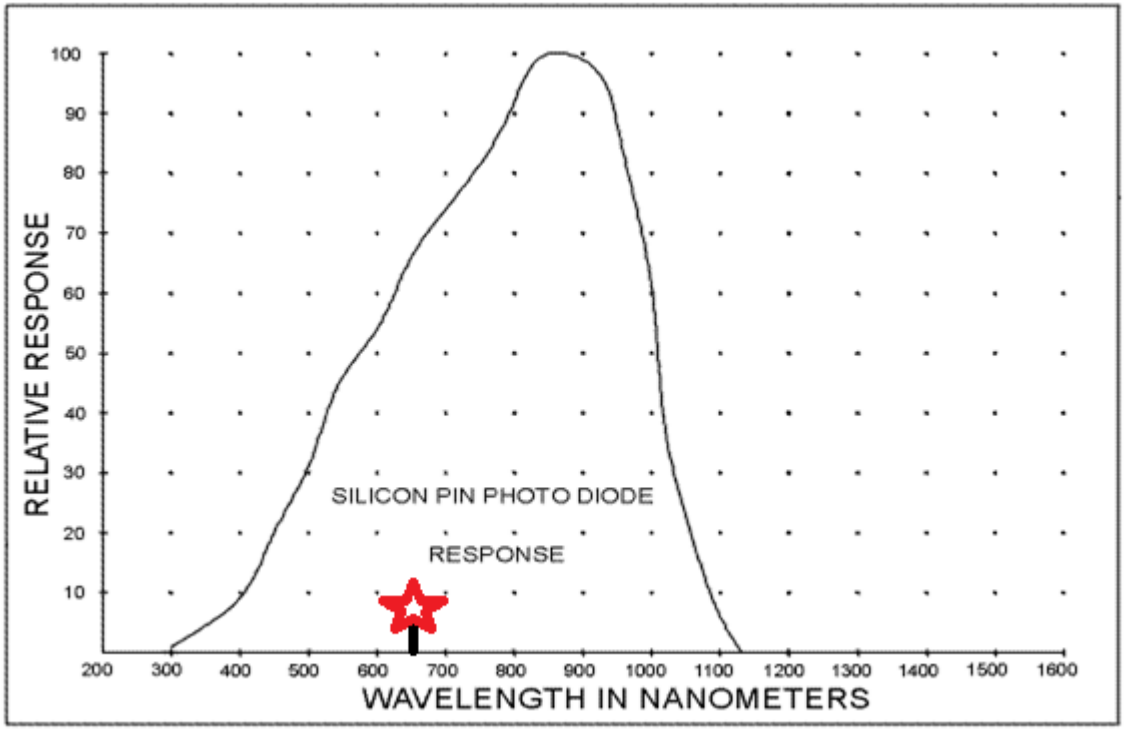
- NPN silicon type.
- Emitter-Collector voltage: 5V.
- Operating temperature: -40^{0}C to 85^{0}C.
- Dark Current: 100 nA.
- Light Current: 20mA.
- Rise & fall time: 5µs.
- 5mm Radial top.



UCF

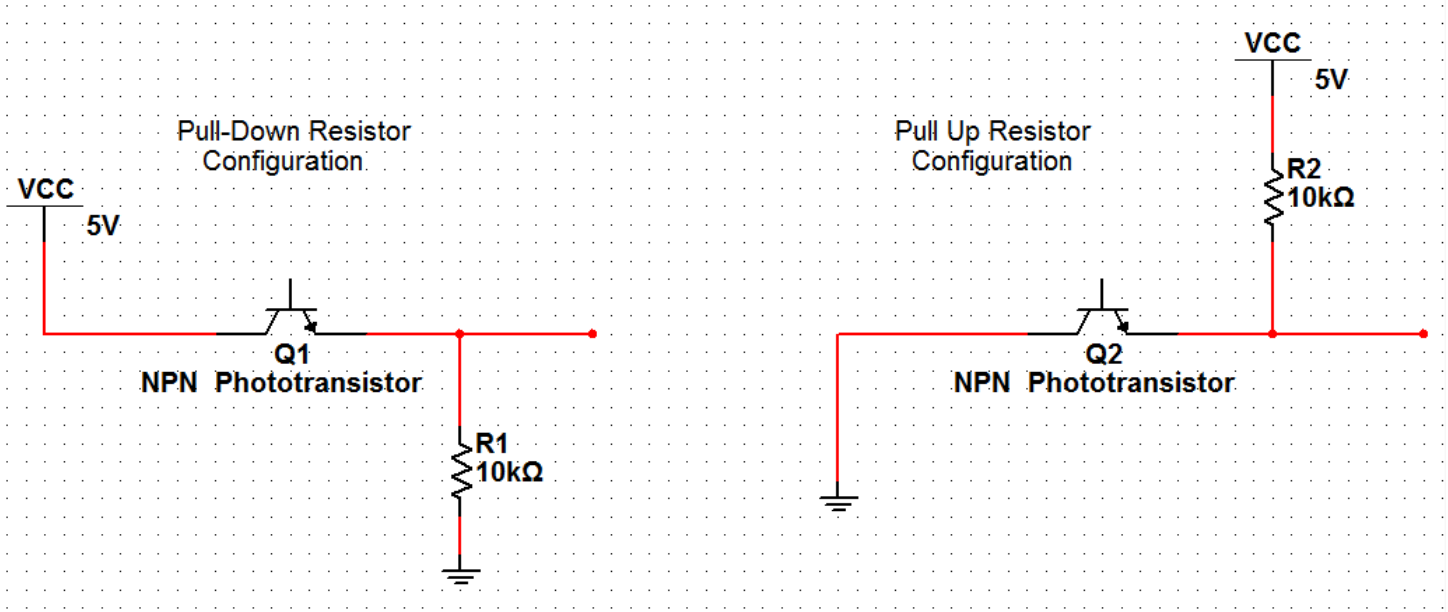
Hole Detection Sensor System

Silicon NPN photodiode response chart:

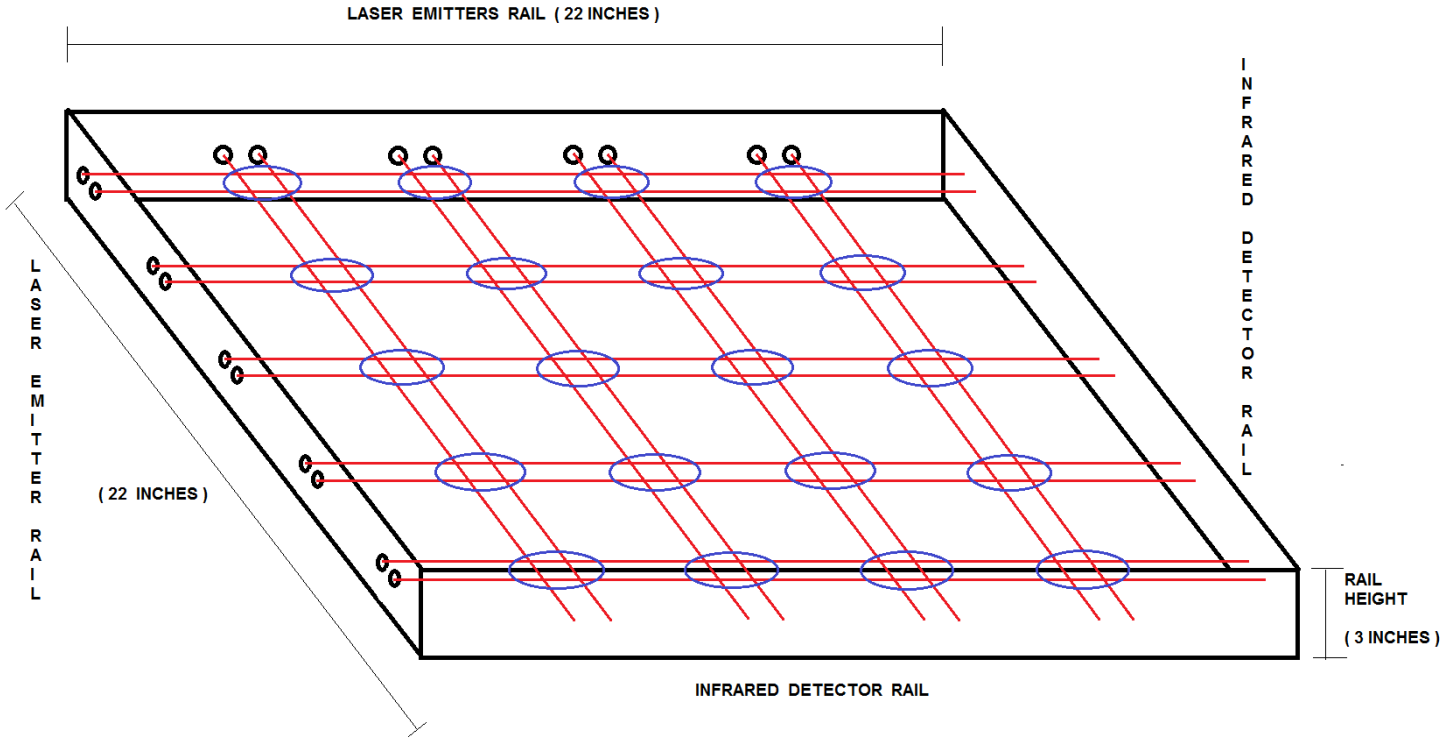


Hole Detection Sensor System

- NPN IR receiver testing worked with the MCU using the pull up resistor configuration

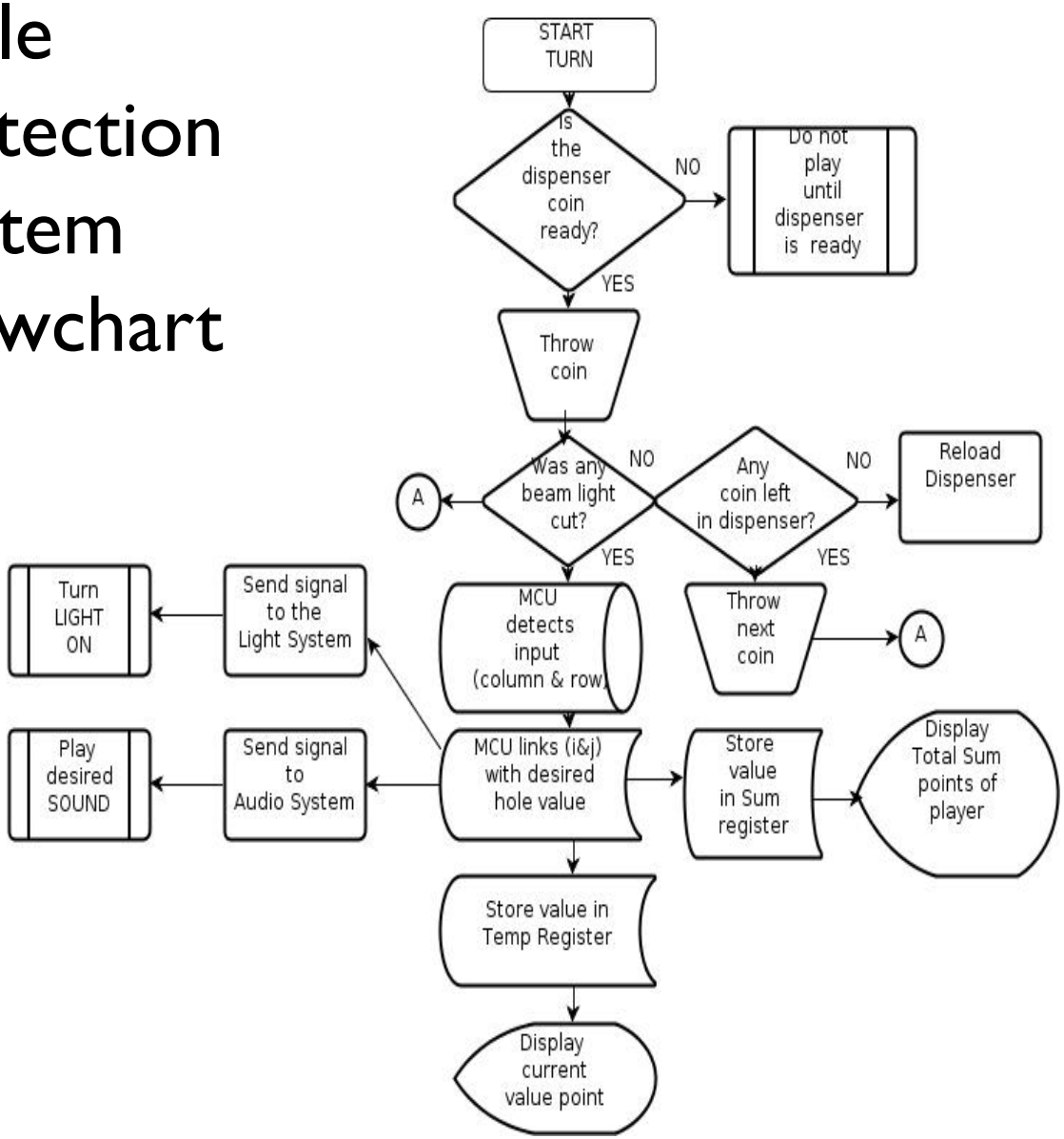


Hole Detection Sensor System



Hole Detection Sensor System

Hole Detection System Flowchart



Coin Dispenser System

- Need to create an interrupt to the current game to let the next player start his turn.
- Add emotion to the game by activating a final counter with a buzzer.
- To create a way of counting the coins left to throw.
- To make it easy to play and avoid holding all the coins on the person's hand while playing.
- Need to create a "pausing" system at the end of each player's game to get time to pick up the coins thrown inside and outside the game box.
- It will restart the game to the next player once all the coins are placed back into the dispenser.

UCF

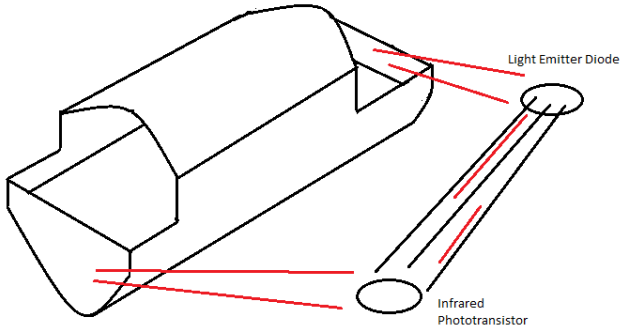
Coin Dispenser System

- Build up a pedestal from the floor to about 3 feet tall
- It will end up in the coin dispenser body composed by 1.5 inches diameter pvc tube of about 8 inches long.
- It will have a bigger open end on top that will serve as a funnel to put in the coins and will be placed or mounted in an incline position so the coins can go down by gravity.
- At the lower end of the dispenser tube we will cut a semicircle slit where the body of the coins will be exposed to be easily picked up by the player.

UCF

Coin Dispenser System

- The "sensing" part is going to be composed by a pair of emitter laser diode and an infrared receiver.
- Similar to the previously configuration used to the MCU connection, we will be using the pull-up connection.
- While the beam is NOT made, the game continues.
- Once the beam is made, a counter starts and the game pauses until the dispenser is reloaded.

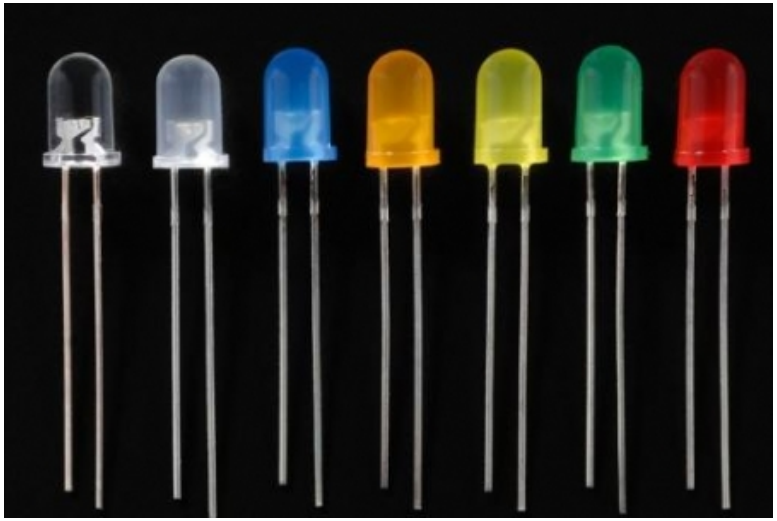


UCF

LED Lighting System

LED Specifications:

- Operating current is 20 mA.
- Life Span: 50,000 hours.
- Operates at 25°C.
- Estimated usage of 128 LED's.
- Customized LED boards suitable for MAX7219.



UCF

LED Lighting System

LED Specifications:

Type	Colour	I_F max.	V_F typ.	V_F max.	V_R max.	Luminous intensity	Viewing angle	Wavelength
Standard	**Red**	**30mA**	**1.7V**	2.1V	5V	5mcd @ 10mA	60°	660nm
Standard	**Bright red**	**30mA**	**2.0V**	2.5V	5V	80mcd @ 10mA	60°	625nm
Standard	**Yellow**	**30mA**	**2.1V**	2.5V	5V	32mcd @ 10mA	60°	590nm
Standard	**Green**	**25mA**	**2.2V**	2.5V	5V	32mcd @ 10mA	60°	565nm
High intensity	**Blue**	**30mA**	**4.5V**	5.5V	5V	60mcd @ 20mA	50°	430nm
Super bright	**Red**	**30mA**	**1.85V**	2.5V	5V	500mcd @ 20mA	60°	660nm
Low current	**Red**	**30mA**	**1.7V**	2.0V	5V	5mcd @ 2mA	60°	625nm

UCF

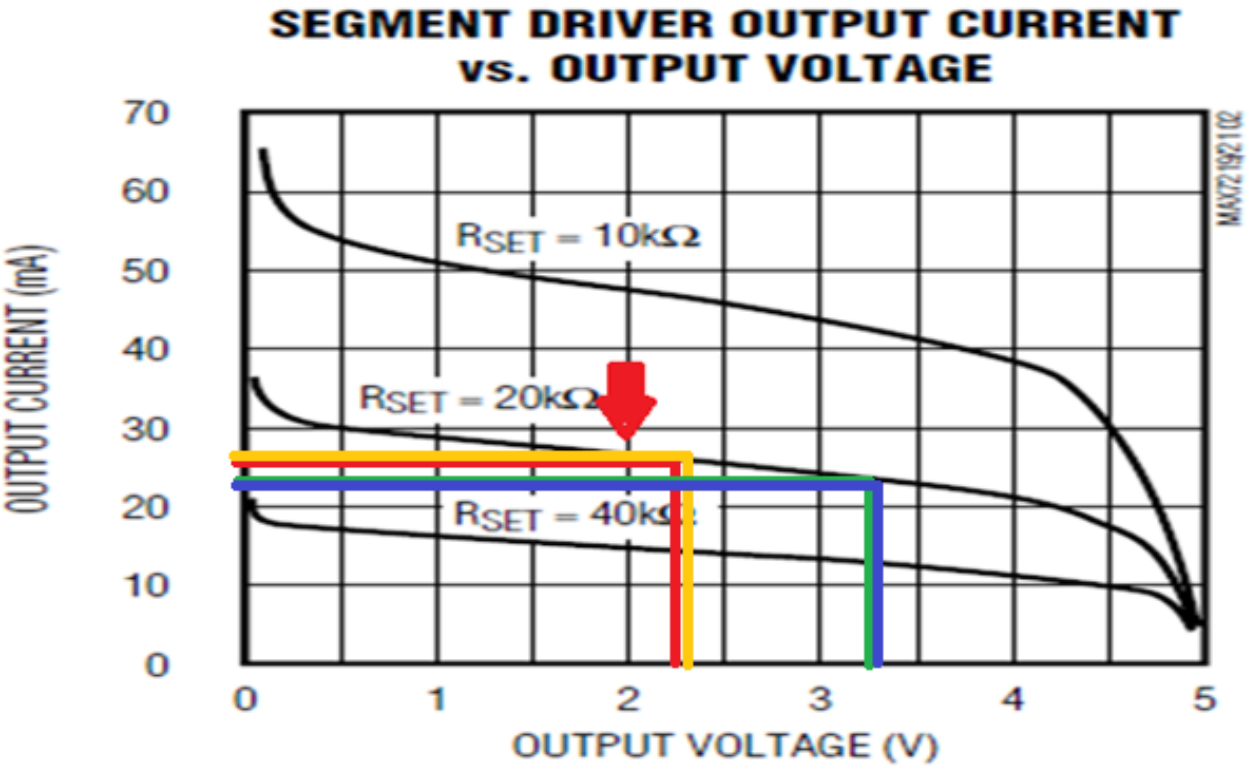
LED Lighting System

MAX7219:

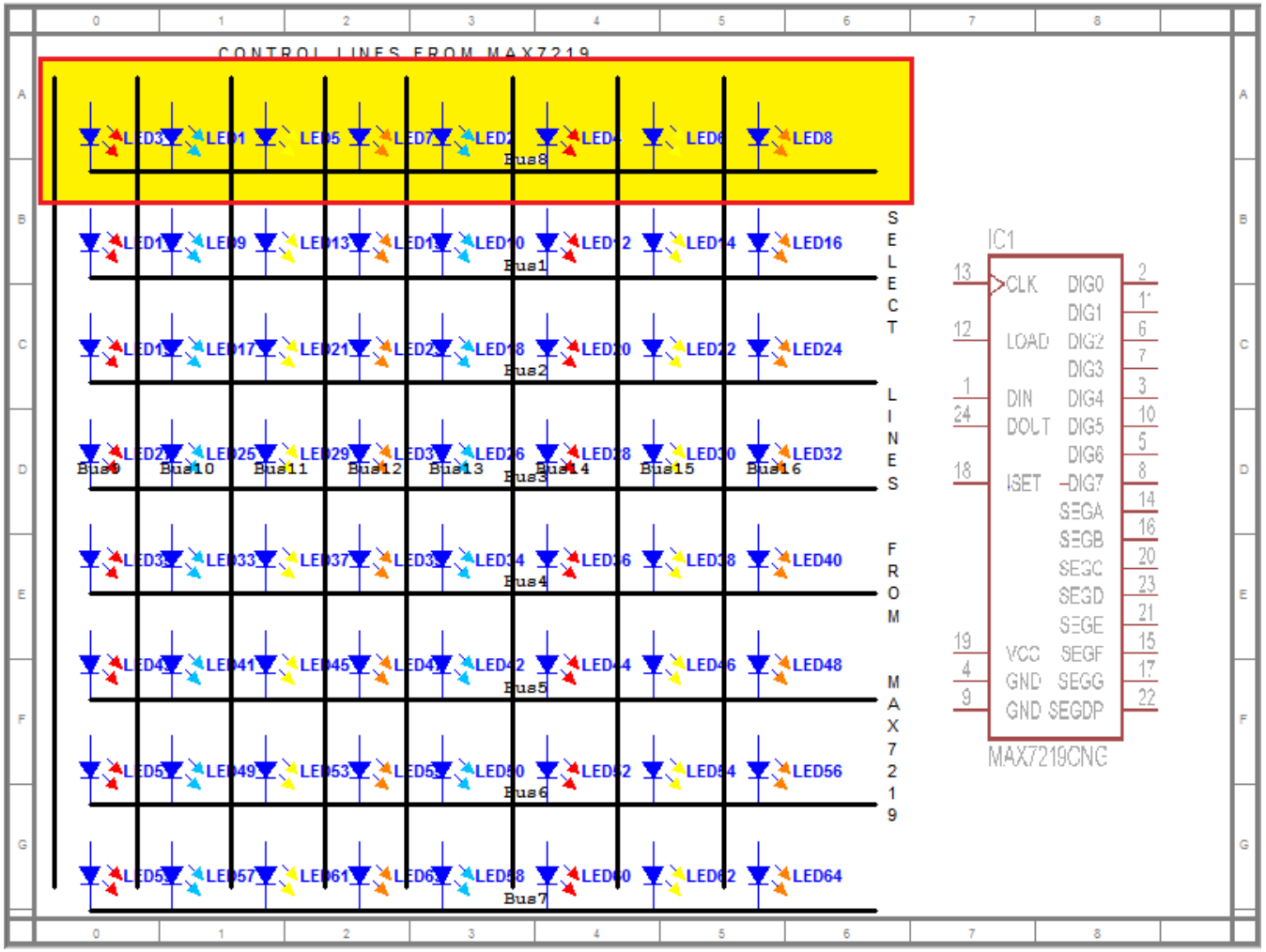
- The MAX7219 is a compact, common cathode display driver that interface microprocessors to 7-segment numeric LED displays of up to 8 digits, or 64 individual LEDs.
- Our system would only need one resistor to set the current to all 64 LED's

LED Lighting System

- Max7219 Output current vs. Output Voltage



LED Lighting System



Threshold Sensor System

Implementation in the E-Frog game:

- Minimum throwing distance: 15 ft.
- The sensor will be used to determine if a player has crossed the predetermined throwing distance.
- If player steps on sensor, the throw does not count and no points will be awarded.

UCF

Threshold Sensor System

Force Sensing Resistor:

- Force Sensing Resistors (FSR) are devices which exhibit a decrease in resistance with an increase in the force applied to the active surface.
- The sensor chosen is the Braun 31221A.
- Widely used in the handicap industry.

UCF

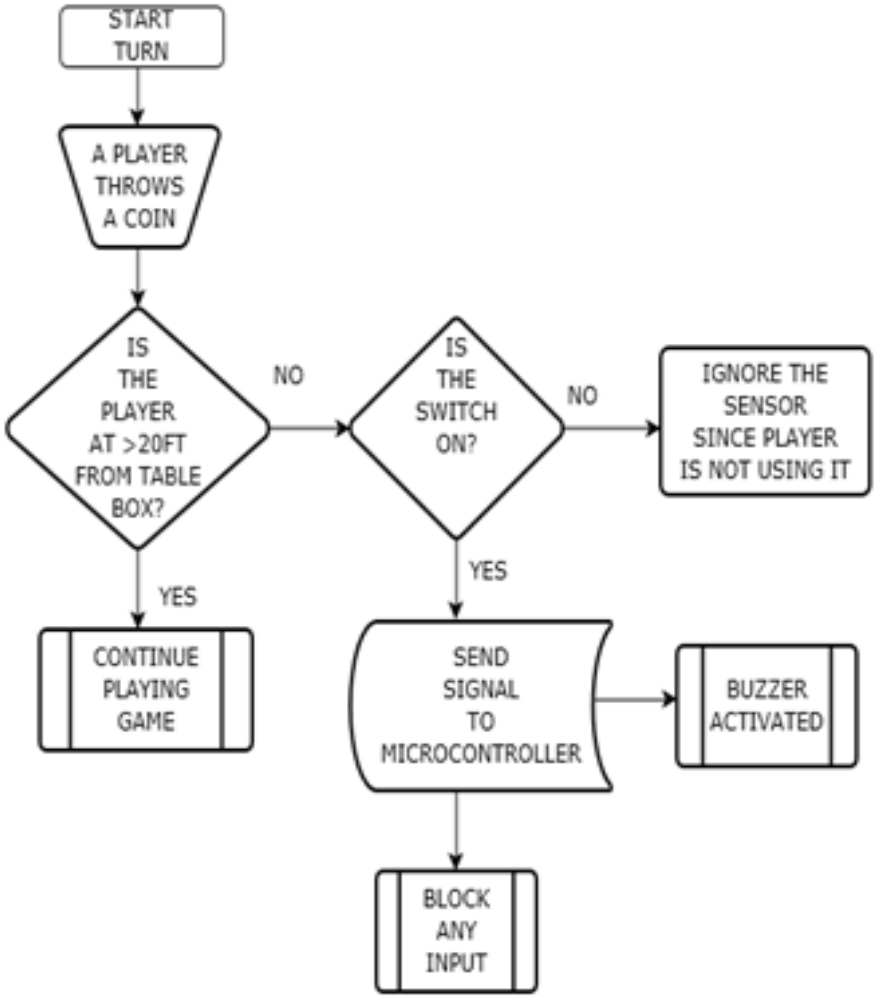
Threshold Sensor System

Specifications:

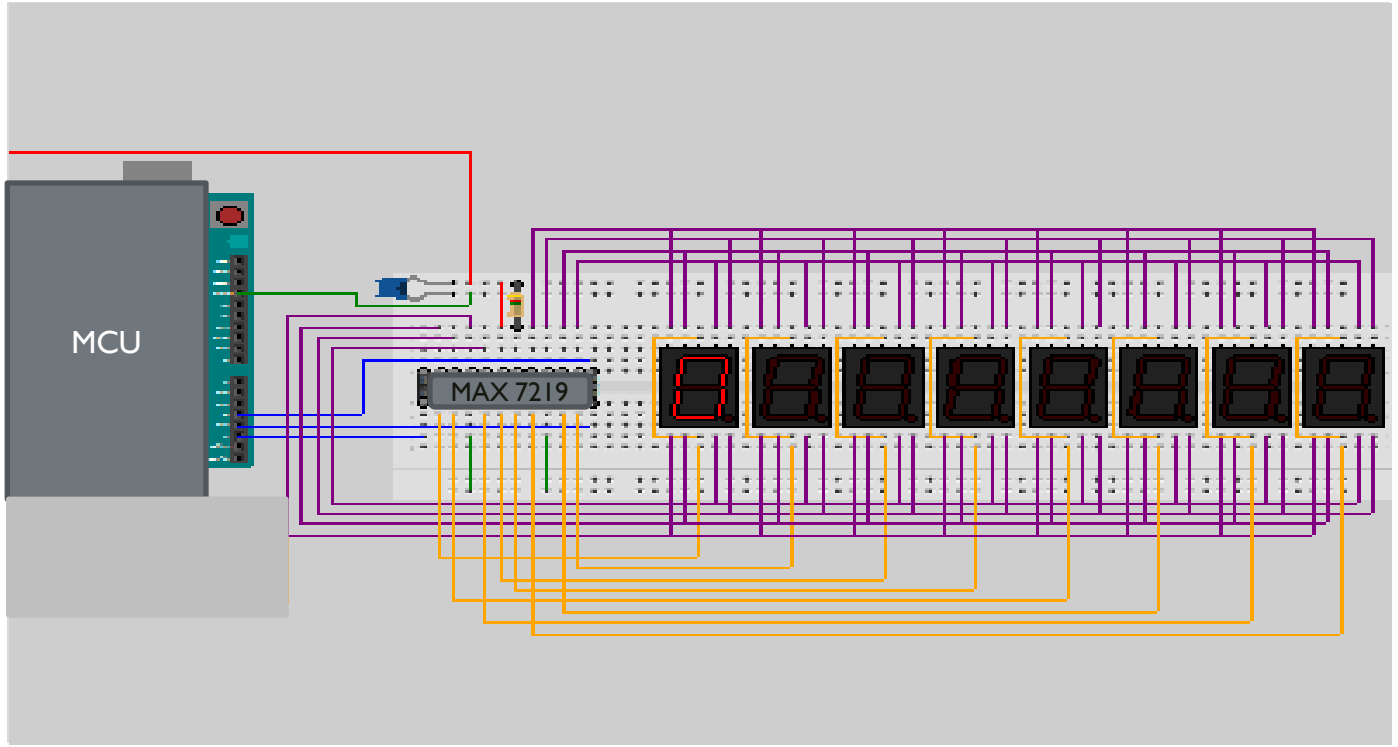
- Size: 2” x 24” (5.08cm x 61 cm).
- Thickness: 0.20” (5 mm).
- Force Sensitivity Range: 6 lbs. to 300 lbs.
- Rise Time 1-2 msec.
- Lifetime: 1 million actuations.
- Temperature Range -30°C to 70°C.
- Sensitivity to Noise/Vibration not significantly affected.

UCF

Threshold System Flowchart



LED Display and MAX 7219 Driver



Dimensions : 6cm x 2.2cm

UCF

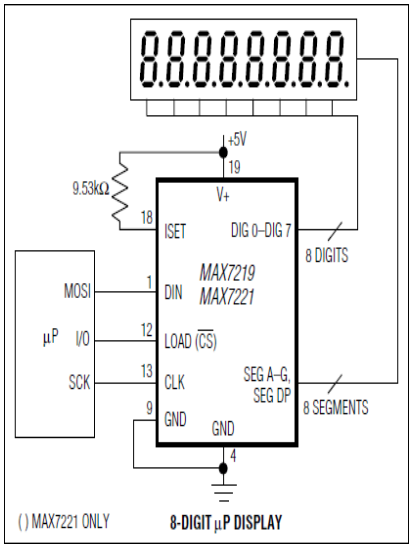
MAX 7219 Driver

- Serial input/output common-cathode
- Interface MC to 7-seg LED displays (8 digits) via SPI bus.
- Included on-chip are: a BCD code-B decoder, multiplex scan circuitry, and an 8x8 static RAM that stores each digit.
- Only one external R is required to set the segment I for all LEDs.
- Individual digits may be addressed and updated without rewriting the entire display.
- 150μA low-power shutdown mode, anal and dig brightness control, a scan-limit register, and a test mode.

UCF

MAX 7219 with 8-Digit LED Display Module Specifications

- 10MHz Serial Interface .
-Individual LED Seg Control.
-Decode/No-Decode Digit.
-Dig & Anal Brightness Control.
-Display Blanked on Power-Up .
-SPI, QSPI, MICROWIRE Serial Interface.
-24-Pin DIP and SO Packages.

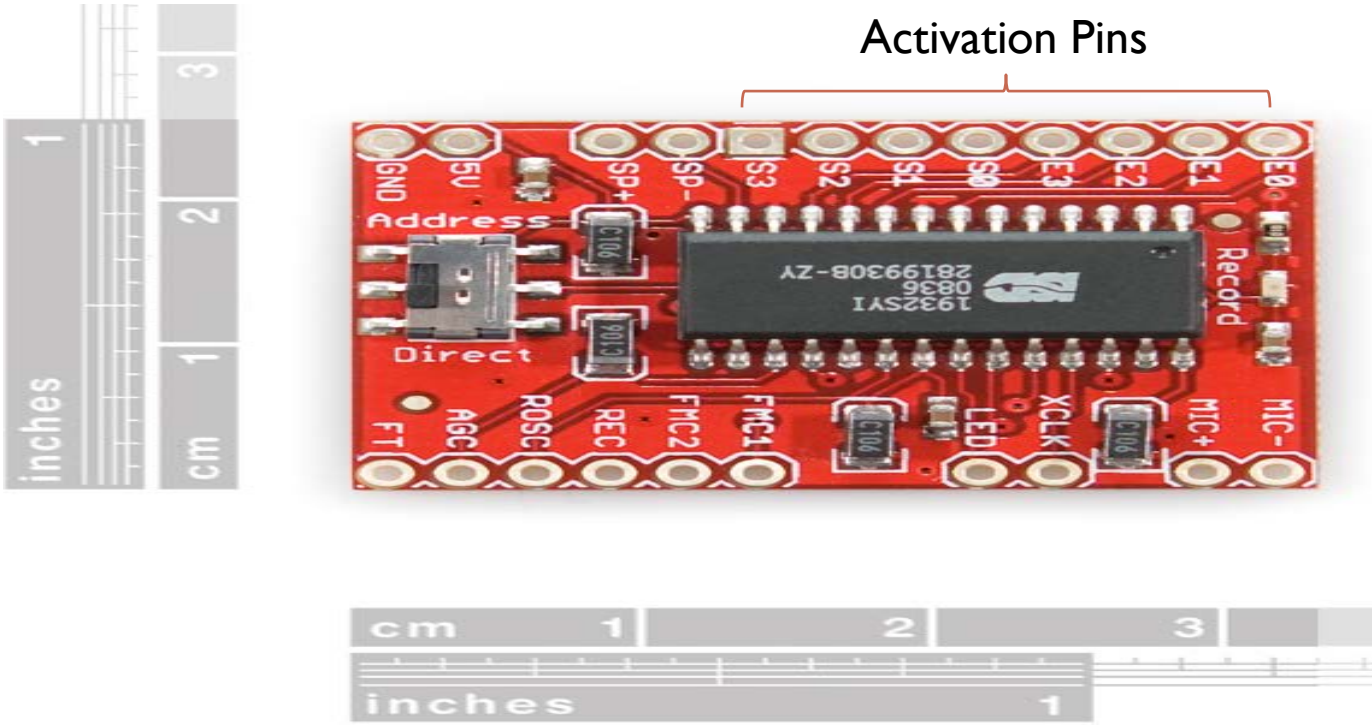


Sound System: ISD 1932

- Supply Voltage 2.4V to 5.5V
- Two operational modes: Address and Direct
- Different Sampling Frequencies and duration based on an external resistor
- Microphone is included in the board as well as an auxiliary input
- Automatically power down after each operation cycle

UCF

Sound System (ISD 1932)

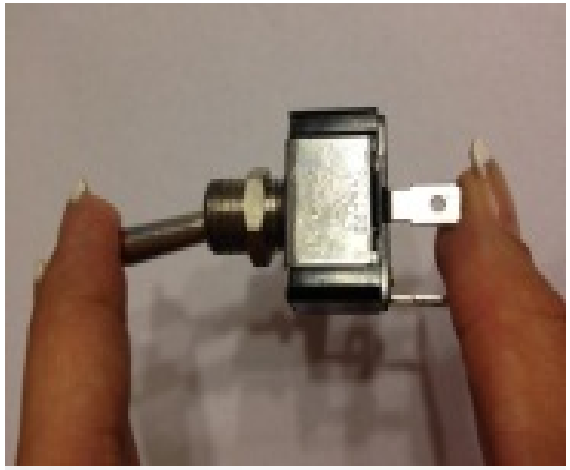


Sampling Frequency	12 kHz	8 kHz	6.4 kHz	5.3 kHz	4 kHz
Rosc	53.3 KΩ	80 KΩ	100 KΩ	120 KΩ	160 KΩ
ISD1932	21.3 sec	32 sec	40 sec	48 sec	64 sec

Enable/disable and function switches

SPDT(ON/OFF)

- Located on low back of table.
- 10A for 277VAC /20A for 125VAC.
- Dimensions: 58.6mm by 21.5mm and 31mm.
- $3.15each.



ARCADE (Momentary buttons)

- Located on the side of the box
- RESET (red), START (green), SELECT (black).
- Switching currents of 10A to 21A at 250VAC
- Dimensions: length is 2.125 in and width 0.875 in. Price $ 3.95

Enable/disable and function switches

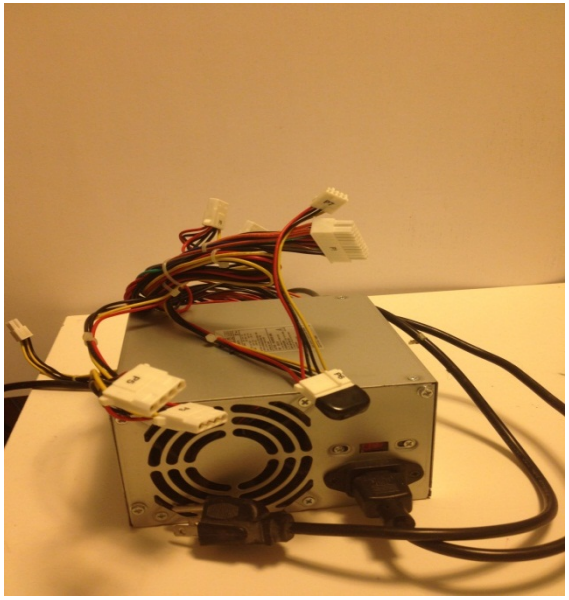
Slide Switch SPST

- Located on the back of the table.
- SPST ON/OFF
- Switching current of 11A EYELET at 125 VAC
- Dimensions: length 1.33 in, width 0.55 in, and button height 0.344 in.
- $0.67 each

UCF

Power

- ATX Computer Power Supply
- 350 Watts.
- Reliable, Clean electricity,
- Multiple levels of power.
- 12, -12, 3.3, 5v available.
- No testing required.
- Equipped with over current protection.



UCF

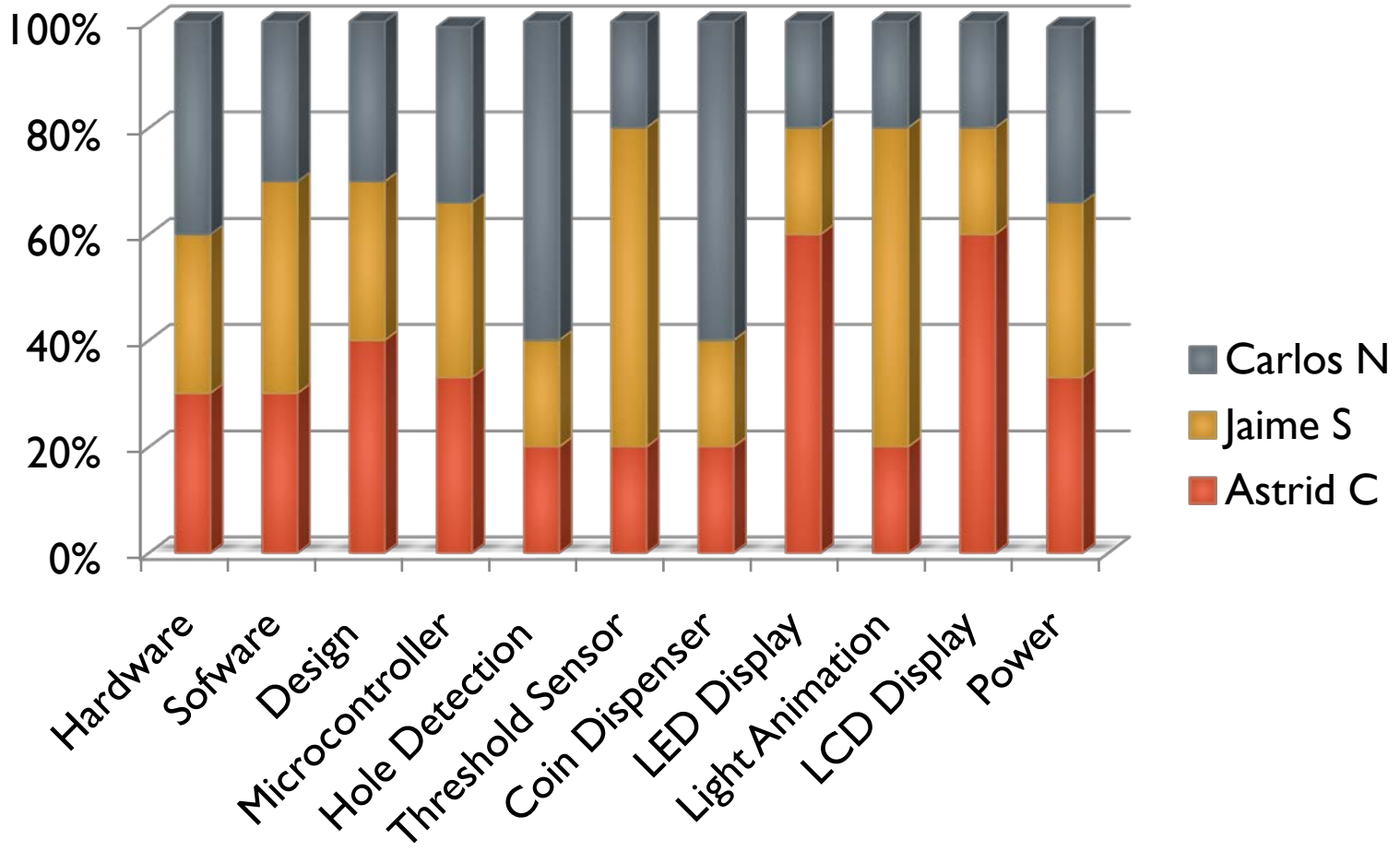
Power

Power Distribution:

- Relatively low power amounts are going to be needed for this game.
- Microcontroller board is going to be powered by the 12V power supply.
- NPN Phototransistors will be powered by the 5V power supply.
- LEDs, drivers, display, and lasers will be powered by the 3.3V power source.

UCF

Work Distribution



Budget and Financing

DATE	NAME	DEVICE	QTY.	COST	TOTAL
JUNE	CARLOS NEYRA	MSP430 (OL)	2	$8.60	8.60
JULY 17	JAIME SALAZAR	LEDS, 7SEGLED DISP (SC)	6,6	$3.21	11.81
JULY 17	ASTRID CRUZ	EMMITER-RECEIVER, transistor (RS)	1,1	$5.20	17.01
July 19	CARLOS NEYRA	LASERS (OL)	10	$25.00	42.01
July 27	ASTRID CRUZ	ARCADE BUTTONS SET OF 3 (OL)	1	$6.90	48.91
Aug 23	CARLOS NEYRA	SOUND CHIP (OL)	1	$24.62	73.53
Aug 23	ASTRID CRUZ	ARDUINO UNO & RECEIVERS (RS)	1, 3	$39.90	113.43
Aug 25	CARLOS NEYRA	WOOD & PVC (HD)	1,4	$4.00	117.43
Aug 26	JAIME SALAZAR	CABLE (DOUBLE CORD) (RS)	1	$6.06	123.49
Aug 27	CARLOS NEYRA	RECEIVERS & BREADBOARD (RS)	3,1	$6.39	129.88
Aug 30	JAIME SALAZAR	RECEIVERS, LASERS & DISPLAY (eb)	10,10,1	$43.46	173.34
Sep 5	CARLOS NEYRA	MAX 7219	2	$5.70	179.04
Sep 6	CARLOS NEYRA	LEDS	25	$9.29	$ 188.33
Sep 7	CARLOS NEYRA	LED LIGHTS	200	$5.58	$193.91

ONLINE= OL
RADIOSHACK = RS
HOME DEPOT = HD
SKY CRAFT = SC

TOTAL SPENT SO FAR: $193.91
EXPECTED BUDGET: $450.00
SELF-FUNDED: $150 per member

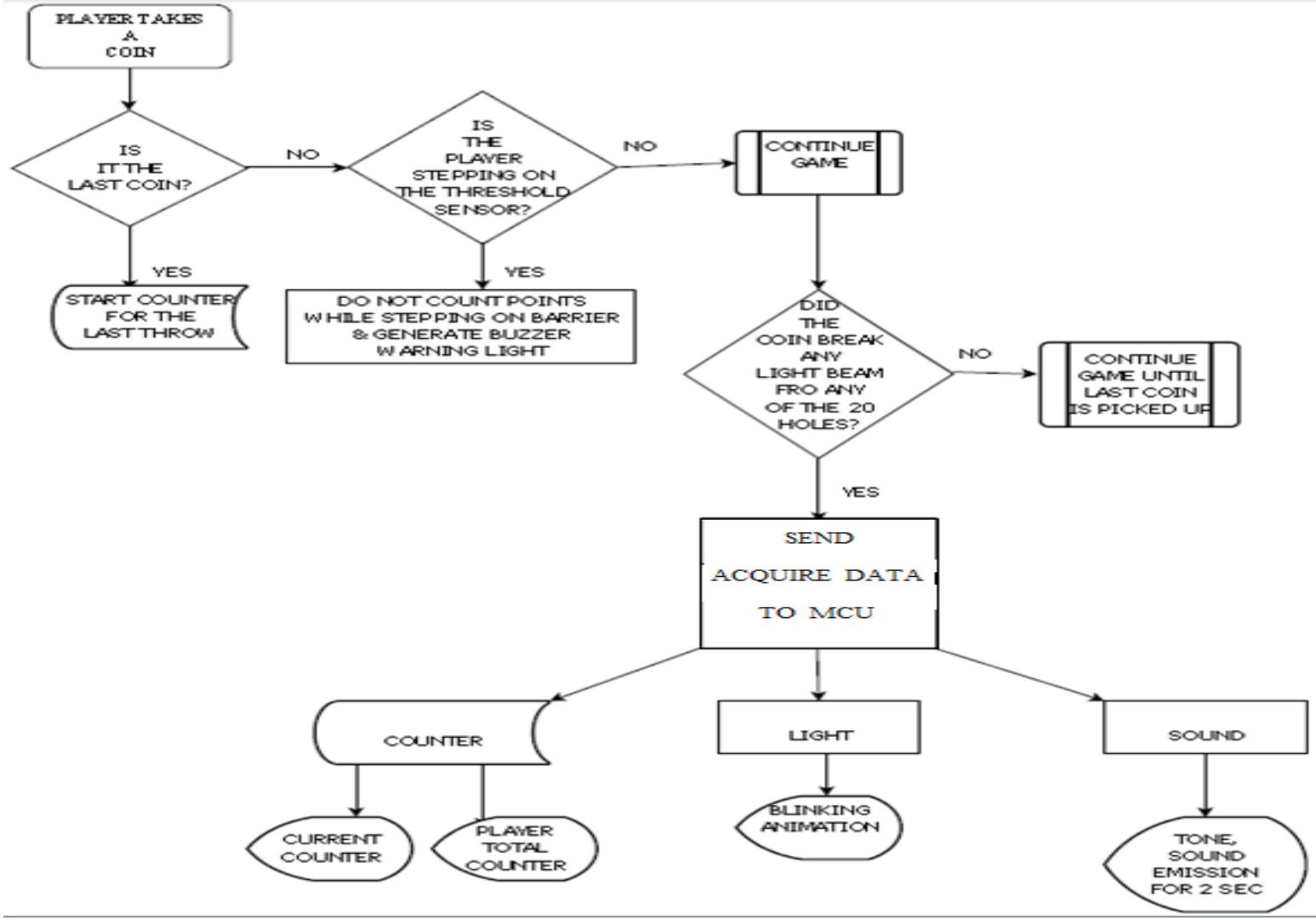
UCF

Remaining Tasks And Problems

- PCB Design in Eagle CAD
- Testing Sound Chip
- Testing LED Display
- Finish Programming LED display
- Power Distribution to be Designed
- Construction of final holed box

UCF

Complete Game Flow Chart



THANK YOU!

QUESTIONS??

Let the Game Begin!

UCF

THANKS

UCF