

# E-Frog Game

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**Abstract** — The objective of this project is to provide an easy, fun, and interactive way to facilitate a coin throwing skill game. The E-Frog Game purpose is to look for a way out of people's daily and stressful life, helping them forget of their problems, and give them a boost much needed. The challenging part was designing and building this new fun product that had never been implemented to this scale before. Adding a score keeping display, lights animation system, audio system, score panel, coin dispenser, and threshold sensor; everything controlled under the supervision and command of the main microcontroller unit.

**Index Terms** — Audio System, Coin Dispenser System, Diode lasers, E-Frog Game, Infrared Receivers, Led Display, Threshold System.

## I. INTRODUCTION

Today biggest cause of sickness and problems is the stress. People get too concern about their agitated lifestyle overloaded with too much work, family stress, lack of time for their enjoyment, and bad habits of sleep. We, Astrid, Jaime, and Carlos are part of this stressful society since we have to deal daily with the load of responsibilities such as full time jobs, time with the family, school classes and homework.

It's been a year since we study together and we found a way to relax in between study time, and one of the big sources of relaxation that we found was the "Sapo" game that Carlos has in his house and brought it from Peru, South America.

We all loved this game since day one since it's a very traditional game played in Colombia and Peru. As the months went by, we thought... "Why we don't implement and create an electronic version of this fun game and make it easier to use and more attractive?"

Studying and working hard every day could be stressful and tiring for many people. In order to relax people enrolled in bad habits or addictions. Sometimes people quit jobs or school because of the society pressure.

In addition, we noticed that student's daily routine can cause exhaustion, and might influence in the class performance and therefore have some consequences in their grade.

Our group thought about and innovative design that will resolve the issues of students and employees in means of stress situations.

The electronic Frog game will be an intelligent hi-tech product made with high quality components. It will be easy to use indoors. The most important thing is that you will be able to take it where you want to go and it could be easily played.

An Electronic powered game will resolve the issues of stress employees and students have from one place to another and to be able to bring it everywhere because of its portability.

This Electronic Game will reduce the issues of stress that students and people are experiencing today. We decided to call this innovative concept the E-FROG GAME, or in other words the Electronic Entertainment Coin Throwing Game.

## II. DESCRIPTION

The E-FROG GAME is made based on its original predecessor, "The Sapo Game", which is a game that consists in a wooden table with holes at the top where there are some obstacles at the first row and the main attraction of the game further back at the middle of the table, the bronze frog. The coins slide down through a tunnel built in each one of the holes down to an incline that guides them to the front of the table to be collected at the end of each game and manually counted depending on which hole each one of the coins landed.

The concept of this traditional game is very simple and fun, but as we have said before, our vision to make this project even more attractive and 'eye catching' by adding new features such as lights, sounds, and some limiting barriers that will help the game be conducted in a more standard way to all players, leaving no allowances for cheating or miscounting.

Since our game is going to have a system that will detect and count automatically the points in each one of the holes, we are going to describe this game as a two-part description game which is composed mainly into the following parts; the hardware and the electronic part.

Physically the game is made of a standing wood table box of 4ft height, and the top box of the game dimensions are 24''x 24'' x 8''. On the top of this table, we have 20 holes evenly spaced out one from another in an array of 5 columns and 4 rows. Each hole has a diameter of 3''. The main attraction of the game, the bronze frog, is located right at the middle of this array. Also, 3 flipping obstacles are located in the first row of holes. Each hole is going to represent a different value having of course the highest points where the frog and the 3 obstacles are located. A number of 10 bronze coins of 1'5'' diameter and 1 ounce of weight are going to be used to throw them from a

specific distance to the top of the wooden box where the frog and holes are located. Since the game does not need the sliders to be built in each one of the holes because the counting part of the points is going to be counted by our sensor unit, our game model is going to have a slight different construction from the original one. There is going to be only one big slider guiding all the coins to the front of the game so when the coins pass by any hole, the determined sensor will take account of the input sending the information to the microcontroller for later processing as the coin falls on top of this inclined base that will make it fall through a collecting opening where all the coins will be picked up at the end of each game.

Figure 1, below, depicts a traditional Sapó Game played in South America; the picture was taken at the house of one of the members of the group.



Fig: 1. Traditional Frog Game

The electronic part of this project consists of quite a few improvements that we have added to this game. Such addition include the infrared laser array emitters/sensors that are going to take care of the counting of the thrown coins that pass through the holes sending the information to its corresponding microcontroller for its proper handling; the system of decorative LED lights that are going to be surrounding the wooden table box that will serve as an attractive to the game, especially if the game is decided to be played indoors; the hidden speakers that will play the sound effects that will sound according to each specific situation of the game; the scan sensor that will

detect all coins thrown around the table box and by doing this the game will automatically count the hits and the misses of the game; the interactive light system that will flash according to the situation of the game, a threshold sensor that will keep account of the proper distance from the game and it will avoid that some players will take advantage in getting closer to the unit for cheating during the game, this will work very similar like the barrier sensors used in bowling that penalties a player if it crosses the line of game; a display unit showing up the current scores of the players and the total score as well; a system of selecting bottoms to configure the game based on the number of players and requirements; all the proper electronic components such as wires, microcontrollers, resistors, inductors, capacitors, battery, chargers, diodes, and so on needed to interconnect the previously mentioned system.

#### *Sensor Objectives*

The hole-detection sensory system is going to be composed of an infrared barrier that will play a critical part of the E-Frog Game. It will allow the system to distinguish on which hole the coin has passed through and it will be responsible of “telling” the microcontroller such information for a proper handling of the data. To do this, two laser arrays and two emitter arrays will be strategically placed underneath the holed table and will work in together to detect the passing of the coin through the detection planes forming a matrix array. When the coin passes through any of the holes, the system will detect the passing of the coin by ‘sensing’ the temporary cut of the constant signal through a pair of laser/receiver and knowing which pair has got interrupted we will be able to determine which hole has been used. The implementation and addition of a distance sensor to set up a threshold predetermined distance is also used and incorporated in this game.

#### *HDSS (Hole-Detection Sensory System) 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.
- If all the conditions are met with the coin dispenser and threshold status, and the coin passes through any of the holes is considered a hit.
- Threshold sensor sets minimum distance allowed for a player to throw a coin.
- Sound system alerts a player when the line is crossed.

### III. SYSTEM COMPONENTS

The following block diagram [figure 2] shows the parts (features and systems) that the E-FROG GAME will use and the overall interactive behavior between them to

perform correctly. As the figure shown below, the system has four inputs: hole detection sensory system, threshold distance sensory system, coin dispenser system, and enable-disable switches. These four inputs were designed and programmed to be connected to the microcontroller unit which receives all data from the inputs to control and lead the function of each sensor system in order to perform a total of four outputs: display screen counter, visual animation system, audio effects system, and temporary panel score.

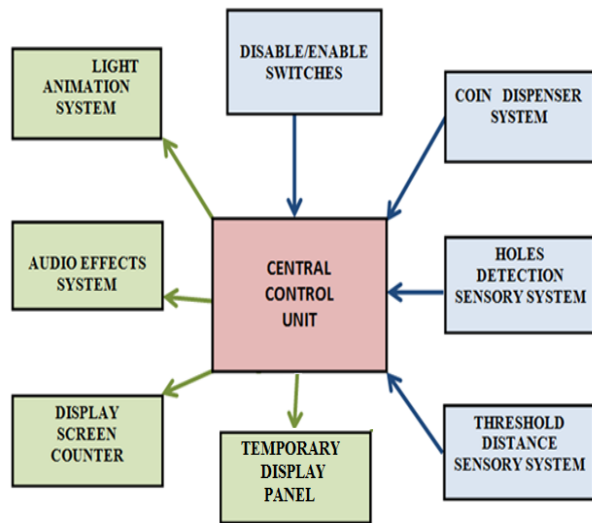


Fig 2: Block Diagram of the E-Frog Game

### Central Control (ATMEL 2560)

The system that will control majority of the systems used in the E-FROG game is an ATMEL2560 microcontroller. As the central control unit, the ATMEL2560 microcontroller is responsible handling data that is sent to and received by the surrounding sub-systems. The Atmel 2560 is a chip in the 1280 family of Atmel chips. It is an 8 bit AVR modified RISC architecture, with 32 8 bit general purpose registers. It has 54 digital IO pins, 16 analog input pins. It has 128KB of flash memory and 8KB of RAM. The clock speed of the chip is 16 MHz and CPU speed capable of 16 MIPS.

There are a few different power modes for the chip for power saving. When active at 1 MHz it will draw 500 micro amps, but will only draw .1 micro amps in power down mode. Our system will not need to be active at all times so this feature will save power.

The 2560 is the chip in the Arduino Mega development board. This means that there are many open source libraries that work directly with the chip which will greatly reduce the amount of coding necessary for the project. There are also many examples of projects using this chip. Another perk of using this chip is that you can program them with another Arduino connected via USB to

the computer with the source code, and you do not have to buy an expensive In System Programming (ISP) device.

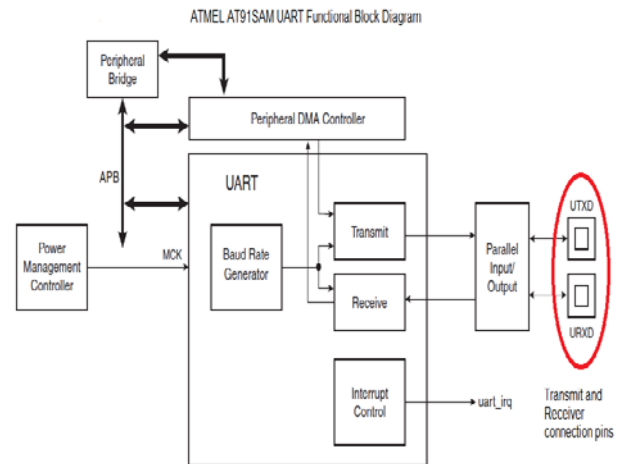


Fig 3: Atmel Functional Block Diagram

### Microcontroller Programming

In order for our E-FROG GAME system works, we, group number six have to program the microcontroller chosen; we need to load a program before the microcontroller is useful. We found a massive diversity of microcontroller families to select from with different architectures, input/output ports, and internal memory. Determining a proper controller is a factor that will be important to the design process because it will drive the rest of the programming throughout an easier or harder path depending in how we choose to arrange the data to the chosen controller.

This decision is the most important in our project since the MCU will be in charge of many important duties such as communicate with each system, keep track of scores and number of coins, control LEDS animation, and display data on the display monitor. Most of the microcontrollers are programmed through their own language, similar to the Assembly language. There are development kits for all the microcontrollers, which can make programming easier with the C Language. Apart from the immense majority of hardware resources required to implement the project functional requirements it is imperative that a suitable programming architecture be chosen in order to execute the desired functionalities defined by the project scope. Not only must the programming environment enable the implementation of the desired functionalities, it must also limit on the amount of code for which solutions already exist. As thus, this section delves into programming languages, code libraries, and other resources that will enable the designers to extract the necessary implementation from the available hardware. Prior to writing the program that will control the device, it is important to have the ability to transfer the program itself to the controller that will act as the mind of

the device. As such, a programmer will enable the team to implement the desired functionality for the available hardware. The device features a USB connection to a computer with the ability to power the target microcontroller when connected.

### C Language

Another common high language used to program microcontrollers is the C Language. The C language is a very popular language for programming microcontrollers. C Language was done previously by group number six members in the intro to C class, but as this is an intro class, it is not as fresh as Assembly, which we used in Computer Organization and Embedded systems classes. Programming with the C Language is based on the development kit that comes with the microcontroller, but most all of them have the option to program the microcontroller with C. Programming with C would also require less time, as recurring code is done utilizing loops. The data microcontroller would definitely require to be programmed in C or some other higher-level programming language.

There is also programming examples on the datasheets of the microcontroller in the C Language that can support the group number six to troubleshoot any errors in code. Programming in C is also made at ease with the header files that are included with the development kits, where many pins of the microcontrollers are defined, which decreases the need for the group number six members to declare these. Very related language to C is the C++ Language which is an object-oriented language. This is not required much in the microcontroller as the use of objects is more used in other higher level projects. Then C++ can still be used but it is not necessary for our E-FROG GAME project.

### Hole-Detection System Using Infrared Barrier

Thanks to the advancements in modern technology, people have gained the ability to tie together the powers of these wavelengths which are outside of the range visibility to the human's eye perception. For example, humans utilize this new approach of technology for X-Ray radiation to view bone structure, also, we use the knowledge learned to handle low frequencies for data and voice communication. Nowadays it looks like there's no part of the electromagnetic spectrum that is outside of human control anymore. As a result of this vast knowledge and handling of light spectrums, one of the very common ranges of wavelengths that humans have been able to adjust and take advantage of it is known as infrared radiation.

One common application of infrared light is its use as a barrier sensor. For example, when someone goes to play bowling we all know that it is prohibited to throw the ball

after the limiting line where the lane starts because it will be considering as a foul for the game. Many bowling systems use the infrared technology to incorporate a barrier sensor that will detect when the player obstructs the light beam and it will send the corresponding broken signal to the 'brain' of the game to let it know that an obstruction through the barrier has happened.

Another good example of the usage of this infrared technology will be an automatic garage door that possesses a set of this sensor and when they are obstructed someone had probably noticed the door becomes inoperable if an object is in the threshold of the door. This is because automatic garage doors make use of an infrared emitter/detector pair in order to sense if an object is in the way of the door, were it to close. Instead of using pulses of light however, this application continuously emits infrared light on one side of the doorway, which is detected on the other side of the doorway by a photo detector. If the beam of light is interrupted, say by a child walking through the doorway, the system disables downward motion of the door.

An emitter/detector pair is relatively simple to implement thanks to today's technology. Using a program like Multisim we were able to construct the following screenshot that shows a configuration which operates in a way which combines the applications described earlier. In the schematic below, an infrared LED continuously emits light. When there is nothing within the working range of the emitter, the detector, in this case another infrared LED will have a constant voltage drop. This voltage drop depends on the operating specifications of the LED. When an object moves within the range of the sensor, infrared light will be reflected off of the object and be detected by the receiver LED. This will increase the voltage drop across the LED, which is detected using the comparator. [Fig. 4]

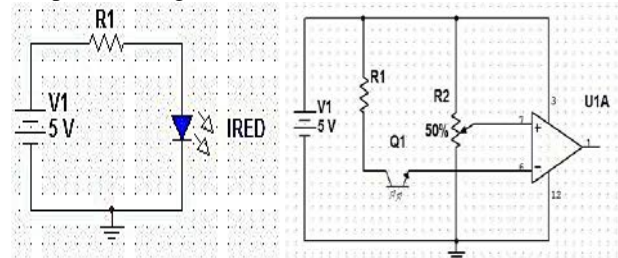


Fig. 4: Simplified Emitter and Detector.

If we would use this technology to implement it into our game we will have to install the emitters and receivers under the holed table top, right after the passage of the coins so these can be detected by our LED array system. Since the plan is to have the LED system installed under the table, we will not have to worry so much about compensating for the effect of ambient light on the

infrared detectors because these will not be easily exposed to the ambient light.

Since the diameter of each one of the holes is about 2 inches and the coin diameter is about 1.15 inches, the chance that the coin will enter the hole in a flat manner is not always expected because the coin may be flipping at the time it enters the hole, so the proper way to detect the coin getting into the hole will be by reducing the upper hole diameter with a funnel-type construction obtained by coupling a PVC reducer from two-to-one and a half inches. By doing so, there was no need to add more lasers and receivers to the construction of each one of the holes, since the reduced diameter will make the coin always break the two beams every time a coin passes through it.

By putting one laser diode shooting in the “X” direction of the hole and another laser diode shooting in the “Y” direction will be enough to cover the circular area of detection. The “X” and “Y” directions cannot be on the same exact plane because they will interfere with each other, so one of them will have to be slightly in a lower plane than the other. By having these two beams crossing the underside of each of the rounded holes we will be covering pretty much all possible detection areas of each one of the holes. The microcontroller unit will have to be properly programmed to recognize all different combinations of possibilities to pick up correctly the inputs from these laser beams broken at the time a coin passes through their shooting range.

The sketch shown below [Fig. 5] is a rough idea of what is desired to do with the infrared laser diode/receiver and the hole dimensions of the table array:

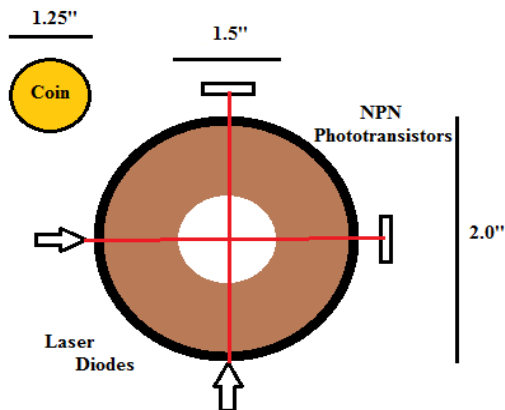


Fig.5 Threshold System Using a Threshold-Strip Sensor

Another type of sensor that the group could be tempted to use is called “Touch-Sensor” or “Position Sensor”. This type of sensor is used in a variety of applications including gaming machines. A strip sensor has a rectangular shape and it detects the position of an object (in this case the player) by the use of small and flexible potentiometers. Two copper strips lie inside the actual strip, and thus when

they make contact, the sensor sends a signal. This force-sensing resistor is a passive component that decreases in resistance when there is an increase in the force applied to the active area, detecting a change when under pressure. The strip sensor is generally designed to sense a force ranging from around 6 pounds to over 300 pounds.

To obtain better and accurate results in the readings, the strip sensor has to be calibrated first by exerting a force evenly applied across the surface area of the strip. This has to be done with a flat surfaced object; otherwise the readings sent by the sensor will be wrong. These types of sensors are low powered and have a linear output. For our project, the strip sensor is located about 20 feet from the E-Frog Game and whenever a player steps on it, the sensor changes from its normal state and sends a signal to the microcontroller that activates the sound system.

This is a simple sensor to implement since the strip goes on the floor and it can be easily moved around. The graph displayed below [Fig. 6] shows the corresponding force vs. the resistance of a 100 pound sensor. From the graph we can see that the resistance (in blue) decreases as the force applied increases. It is important to note that the conductance curve is linear; therefore, it is useful when calibrating the strip-sensor.

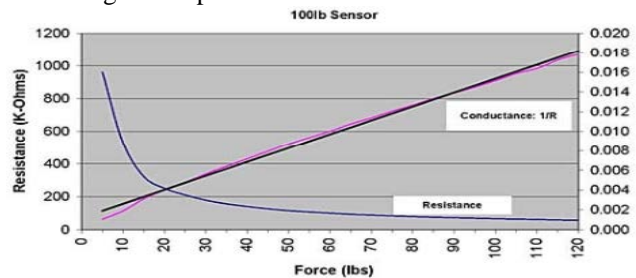


Fig. 6 Force vs. Resistance Plot

#### Coin Detection System:

In all the hardware designs detailed, functionality is roughly the same. Each design relies on detection of an object passing through multiple barriers or through the same barrier multiple times. Due to limitations in number of pins available on some microcontrollers, as well as other limitations, we thought in a different option that can do the same two main purposes of blocking the game from undesired inputs after the last coin has been thrown and, to automatically jump to the next player.

One of the solutions that we came up with is that instead of having a system like the ones explained before with the infrared barriers sensors that will detect the coins as they go towards the game, we will have a system that will detect the coins as they are being taken out from a dispenser. In other words, we will create a dispenser that will count or detect the presence of the coins inside of it and it will send a signal when the last coin has been dispensed out so a timer in the microcontroller starts

counting for the last coin before it blocks the game until the next player. Adding this timer feature will increase the level of emotion and entertainment to the game since the current player will only have a determined amount of time to throw the last coin before the program stops adding points. One of the designs that we thought was to build up a pedestal from the floor to about three feet tall and it will end up in the coin dispenser body composed by an attractive 1.5 inches diameter pvc tube of about 8 inches long that 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.

In the following sketch [Fig. 7] we can see the shape and proposed dimensions and functionality of the coin dispenser, a simple idea for a smart solution:



Fig. 7 Coin Dispenser

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. The trick or creative part of this dispenser will be that it will contain a pair of infrared emitter/detector led light having at the top end the photoelectric detector and at the bottom the infrared emitter diode laser. This pair will make fully contact when the last coin is removed from the dispenser, letting the light beam travel through the center body of the tubular dispenser and activating the signal of the photoelectric detector. This signal will alert the main game controller that the last coin has been removed and it will start a countdown timer of 45 seconds before it blocks any more inputs to the current game. By blocking the inputs we eliminate the chance of dropping by mistake or intentionally any illegal coins to a hole creating a false reading of points. After the coins have been collected for the next player, these will have to be put inside the funnel of the dispenser so the coins will start sliding down to the desired starting position and they will also block the light beam again. This new blockage of light will be interpreted by the microcontroller as the signal to jump to the next player without the need of having to press any mechanical button to change players.

### Display System

The E-Frog game is a project designed to display temporary and total scores per player, so in order to fulfill this requirement, a good display system needed to be implemented. After some research it was found that the LED display was an excellent choice to incorporate visual light scores in the game.

A single 7 segment display consist of eight LEDS including the dot, this screen makes a digit using the position segment corresponding to each digit. Each segment has a letter assigned from a to g as the figure below shows. For instance, if we want to represent number two, then segments a, b, g, e, and would have to be activated. The same way each digit from 0 to 9 can be represented activating (1) or deactivating (0) each segment. Thanks to our current technology and after a lot of investigation and testing, we have found a package part that includes all of these devices.

This is the Serial Seven Segment Display Board MAX 7219. This display is a 24 pin DIP and consists of two boards 4 digits display that are placed one next to the other and includes a binary code decimal BCD decoder to control each digit intensity, 64 single LEDS spread along each one of the segments, character and segment drivers, scan multiplex circuitry, and a static RAM of 8 by 8. This [Fig. 8] is a serial I/O common-cathode screen that communicates with the MCU thru Serial Peripheral Interface (SPI).



Fig. 8 7-Segment LED Display

### Audio System

Among all the other stimulations that we have already added to the E-Frog Game, we also wanted to add one more system that will make it super attractive and exciting to the user and this is the implementation of the audio effects system. How fun and amusing it is when we play a game and we hear some feedback from it. The objective of the audio effects system is to provide a response to the user when certain situations or conditions are met while the game is in operation. These responses can be supportive, exciting, or to emit a warning if the condition applies. The goal is to generate an introductory sounding signal or mode to animate the beginning of the game, another sound to respond when a coin is inserted to a regular low-value hole, a more exciting sound when the coins are inserted into a higher-value hole (the ones with obstacles), a warning buzzer or annoying sound when an invalid input occurs such as stepping onto the threshold, and the most important and attractive sound will occur

when the player hits the main attraction of the game, the bronze frog.

In order to implement and add this interactive sound system, our group performed a research about the different types of audio system available to add it into our project and we found out a few options that we could use. The first question we did was: How can we add audio to a project to be controlled with a microcontroller? It is relatively simple in concept. We will have to find an integrated circuit that consists of some latches. In first step we will have to add an Analog to Digital converter that will transform the sound waves captured or recorded from the emitter voice or source to a digital form to be handled by our program and this is done through a device called A/D converter. Once we have accomplish the task of having the desired analogue data into a digital source (such as the voice changed to the digital value), we can save this information with latches (some type of memory device such as an EEPROM for example) as well. Then, as needed we can handle this stored information in different ways as we need them, and one of the ways that we can get them and play them is done through the Digital to Analog converter.

The Nuvoton's ISD1900 ChipCorder Series is a single-chip multiple-message record/playback device with dual operating modes and wide operating voltage ranging from 2.4V to 5.5V. The sampling frequency can be selected from 4 to 12 kHz via an external resistor, which also determines the duration. The device is designated for mostly standalone applications, and of course, it can be manipulated by a microcontroller, if necessary. This is the most interesting part of this module, that it can be easily adaptable to the main board that we are going to build, saving us some time to finish up some other details concerning about the E-Frog Game.

The following picture [Fig. 9] shows the chosen sound chip module for the audio system taken from the datasheet:

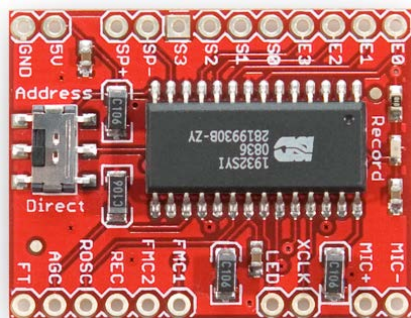


Fig. 9 Sound Chip ISD1932

The two operating modes are Address Mode and Direct Mode. While in Address Mode, both record and playback operations are manipulated according to the start address and end address specified through the start address and end address pins. In Direct Mode, the device can

configure the memory up to as many as eight similar duration messages, pending upon the fixed message configuration settings. With the record or playback feature being pre-selected, each message can be randomly accessed via its message control pin. The device has a selectable differential microphone input with AGC feature or single-ended analog input, AnaIn, under feed-through mode. The audio output is either a differential Class-D PWM direct-drive or a single-ended voltage output (AUX out), depending on the derivative selected.

#### Led Animation System

The E-Frog game will have a light system to give the game a more attractive look. Also, because the game can be played under dark conditions, a lighting system is very helpful so that the players can interact even more with the game. Additionally, the game would have a set of lights next to the display screen where the score is located. The group has agreed that the light system must have a set of animations for a given situation during the game.

The first animation would occur when the game is turned on. The light system in the matrix will power off and on and will run random sequences clockwise or counterclockwise. Another animation will take place when a coin is inserted; two arrows will be displayed pointing down on the matrices, meaning that a coin was detected in one of the holes, so that for every hole there is the same sequence except by the frog which will display the message: "FROG" followed by two happy faces. Also, the system will have an animation that displays an entire row of lights when the threshold sensor is pressed.

The last of the four animations will take place when the laser and receiver of the coin dispenser make contact through the light beam. When this happens, an animation showing a dot moving forward from left to right and then backwards will be displayed.

The following images [Fig. 10] are some animations of the led light system corresponding to three different situations:

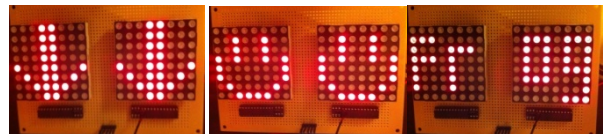


Fig. 10 Matrix Animation

As with the display system which displays the amount of points gotten by a player, the Led animation system will use two MAX7219 chips, with each driving sixty-four separate led's. The MAX7219 is a compact, common cathode display driver that interfaces microprocessors to 64 individual LEDs. The reason of using this type of chip is that our system only needs one resistor to set the current to all 64 LED's. This is very important because the LEDs can easily be damaged if a sudden change in voltage occurs. Therefore, by having a constant current distributed

to all of system lights, any changes in voltages will not affect the system. According to the design of the matrices, and the datasheet from the max7219, the value of the resistor to be used is about 18KΩ.

#### IV. FLOWCHART

The following [Fig. 11] is the general description of the overall operation of the E-Frog Game. This diagram summarizes all systems including the five inputs (Disable and enable switches, scan sensor, hole detection sensor, threshold distance, and user control panel) and the four outputs (visual light animation, audio effects, display screen counter, and decorative lights) of the entire system.

This is how to play the game from player takes a coin to be thrown to display his points, lights, and sound corresponding to his score.

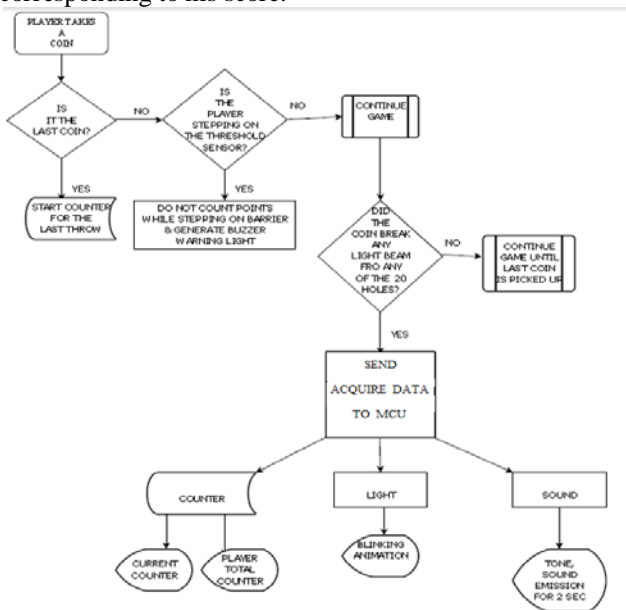


Fig. 11 E-Frog Game General Flowchart

#### V. CONCLUSION

In this very stressful society, where sometimes people want a small amount of time to relax, the E-Frog Game looks to increase the fun of ordinary people by decreasing their stress in an interactive and enjoyable way. The hole-detection system determines if a coin goes through one of the holes. The lighting system is based on four different animations that represent a given situation during the game. The audio system alerts a player when he/she scores, or when other system of the game is utilized. The display system shows the amount of points a player gets in a given round, both by coin thrown, and by the added total. This project allowed us to test our skills as engineers by designing, building, and testing our product

at very high standards. We learned how to work in a team, and what is like to work in a real world type project. Our knowledge was put to the test and our skills to the limit. The satisfaction was the completion of the project.

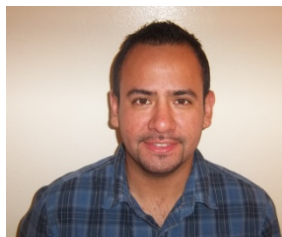
#### ACKNOWLEDGEMENT

The authors wish to acknowledge the assistance and support of Dr. Samuel Richie, Dr. Mikhael Wasfy, Dr. Zak Abichar, and Dr. Chris Bauer; as well as the rest of the professors who have taught them over the past years.

#### BIOGRAPHY



Astrid Cruz is currently a senior at University of Central Florida, majoring in Electrical Engineering, with a minor in Mathematics. She is currently working in the Math Supplemental Learning Program at Valencia College. She plans to obtain a Master Degree within the next two years from graduation.



Carlos Neyra is currently employed by Cubic Defense Applications Systems and plans to be promoted to the engineering department. He will be earning his first B.S. in Electrical Engineering and plans to move straight forward to the workforce seeking a position in the electronics, power systems, digital or analog communications field.



Jaime Salazar is a senior at the University of Central Florida. He plans to graduate in December 2012 with a Bachelor of Science in Electrical Engineering. After graduation he expects to obtain a full time job in the field and also seek for a second Bachelor in Computer Science.

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