Math Math Computation – A sensor based dance pad that provides math lessons to children

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***Abstract* — Mathematics is an intimidating topic for elementary age students. Given that children have different learning styles, it can be very challenging for teachers to create innovative educational activities that accommodate every single student's needs. The development of Math Math Computation emerged as a solution to this challenge. This system, composed of three main components: (1) a mat with pressure sensors, (2) a microcontroller, and (3) a Python application, is an accessible tool that incorporates the main learning methods while promoting ingenuity and fun. This paper describes the approaches implemented for the creation of the design and functional performance of the system.**

***Index Terms* — Arithmetic, Equations, Pressure Sensors, Games, Educational Technology**

I. Introduction

Education is one of the pillars of society. Over the years, many studies and researchers have highlighted the importance of stimulating creativity in the classroom to promote a more engaging academic setting, especially during the early childhood stages. Math Math Computation is a system that provides a fun environment for young children to develop their academic skills while targeting the core learning styles. Through active listening, movement, and visual aids, each student can learn arithmetic operations.

Math Math Computation is a hands-on experience tailored to foster the four main types of learning styles in young children: it requires attentive listening and focused attention while encouraging movement and providing visual aids that they must read. It is a floor mat with pressure sensitive pads connected to a device (a computer or laptop) that displays math questions and has a score detection algorithm. The system targets children between the ages of 6 and 8, corresponding to first, second and third grades. The math related questions cover basic arithmetic operations, more specifically: addition, subtraction, multiplication, and division. The question to be solved is displayed on the screen of the PC (or any other electronic device that has an operating system), then the student reads the question shown and performs the math while stepping on different buttons on the pad until they get the right answer. The mat is divided into eight sections, each indicating an option that the child can step on.

The main objective of the development of Math Math Computation is to provide an easy-to-use learning resource that not only builds a creative environment for children to learn, but also motivates them to be active participants in class. The incorporation of movement into the learning process has the goal of increasing retention in memorization and the dual benefit of encouraging a healthy and active lifestyle. Furthermore, the system is designed with the intention to promote inclusion in the classroom; some students are shier and quieter than others and, because of this reason, they find it challenging to interact with their classmates. The social interaction aspect of the system can help all the students form deeper bonds among themselves, making all of them feel included while also strengthening their interpersonal skills at early ages.

II. Overview of System Design Architecture

For the development of Math Math Computation, three main components were identified: the mat containing the pressure sensors, the custom printed circuit board (PCB) containing the microcontroller (MCU), and the Python application that is displayed in a system such as a computer or a laptop.

The floor mat contains pressure sensors. The mat's play area is a 36" x 36" base board made of plywood with a tarp material on top. There are eight buttons on the mat that the child can step on, each one of them representing an action. The pressure sensors consist of layers of sheets made of conductive materials which cover all buttons. Then, there is a wire going from each button's connection sheet to the microcontroller, which reads when a connection is made between the connection sheet and the grounding sheet by detecting change in voltage.

The PCB contains the MCU alongside other electrical components. The MCU senses a step on a button as an input signal. There are numerous pins on the microcontroller and most of them are usable as general purpose I/O, which allows for the interface of sensors. The microcontroller in our system sends a digital output signal after reading the voltage of its pins. If during the reading of the pin, the MCU reads a high enough voltage, then the MCU returns the value of the pin is high, otherwise returns the value of the pin is low. Changing the pin's voltage from high to low (or vice versa) as the button is pressed, enables the MCU to sense input from the button. The microcontroller sends a signal every time a button panel is stepped on, which is recognized by the Python application running on the computer as a button press.

The Python application, which is a video game, is displayed on a computer or any other device that has an operating system and is able to run a Python script. The video game displays the math questions that the students must answer. The signals read from the MCU are taken as input to select different options in the game. The wires in the mat are connected to the input pins in the PCB, which is also connected to the computer via USB cable. Below, Fig. 1 shows a high-level overview of how the different components interact with each other.

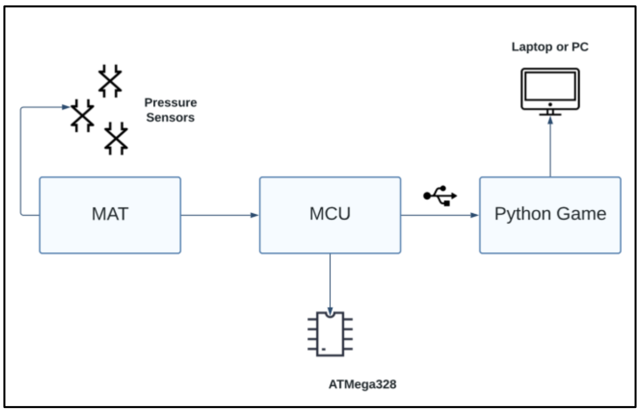

Fig. 1. System Design Diagram.

III. Game Play

The objective of the gaming component of Math Math Computation is to promote fun and competition. At the end of each turn, the student would feel like they do when they finish any other game: they would want to go again so they can achieve a higher score; however, in this case, when doing so, they would be practicing and learning math concepts and questions, connecting fun and excitement with a school subject.

A variety of games were designed to accommodate different skill levels and math knowledge of users. Four modes were developed. These modes in order of least prior knowledge needed to most prior knowledge needed are Learning mode, Flashcard mode, SpeedRun, and Mind the Gap. Learning mode does not require any prior knowledge or memorization of math equations. Flashcard mode requires partial memorization and is meant to help users to acquire proficiency in memorization. SpeedRun and Mind the Gap require proficiency in memorization and are meant to help users acquire an advanced skillset including the ability to answer questions quickly.

A. Learning Mode

A number and operation can be selected and all equations within that category will be taught. For example, multiplication by 3 would contain the 3 times table. These problems are given in a random order. Each time the user presses the button "Enter" to submit an answer, they are told whether they are correct. The session concludes when the user decides to return to the main menu. This game is the most basic mode and allows users to practice their math skills without any time constraints or competition. This mode is useful to users who are unsure of their ability or become anxious with time constraints. For example, the screen initially displays "3x5=15" as soon as the user starts to input values the displayed equation changes to "3x5=?" and the user answer is displayed. This game is the most accessible mode and allows users to acquire skills without previous memorization. Learning mode is different from other modes in that correct answers are given immediately before an input has begun so users can realistically remember the answer even without prior knowledge. This mode is useful for students who are ahead or behind their class in terms of memorization. If they are behind, they can review the introductory material. If a user is ahead, for example has memorized all multiplication equations while the rest of the class is still working on them, that student can move on to division. In this example, the student would likely have insufficient previous exposure to division to comfortably operate any of the other modes. Learning mode would be useful as it teaches new material rather than quizzing previously learning material.

B. Flashcard Mode

This mode functions much in the same way as Learning mode with the only difference being that the answer is not given ahead of time. This mode most closely mimics the traditional way of teaching math memorization which provides familiarity. This familiarity allows users to figure out the operations of this mode quickly and with less confusion than more complicated modes. These conditions allow for increased memorization as illustrated by the following example. The question is 6x7. The user must hit +10 four times and +1 twice. The user must remember the answer the entire time they are hitting the buttons. In addition, the repeated movement of hitting, for example, the +10 button four times provides a physical component to learning, which could aid in memorization. There is also a benefit to the chosen +10 and +1 operations because they give the user a sense of place value. The answer to the previous example is 4 in the ten's place and 2 in the one's place. This system also makes it apparent that 40 is equal to 4 tens which is useful intuition for beginning math students.

C. SpeedRun

This game works much in the same way as flashcard mode in terms of choosing a number and operation. The user is given 60 seconds to input as many correct answers as possible. The user receives a score based on accuracy and how long she/he takes to answer the question. The problems are repeated, if necessary, until the time runs out. As implied by the name, this mode encourages users to think quickly. This mode is beneficial because math skills include both being able to get the correct answer and being able to do so quickly. In addition, the increased sense of competition adds an element of fun. In short, this mode feels more like a game than Flashcard mode. The controls are very similar to that of Flashcard mode which allows users to progress through the modes more easily as they already know the controls. The speed element of this mode also increases physical activity because each answer requires movement. Similar benefits in terms of asserting place value exist in SpeedRun as in Flashcard mode.

D. Mind the Gap

In this game, the user controls a block on a screen that must be put at exactly the right level to pass through an obstacle. The necessary level is given as an arithmetic operation such as 3x7. If the user controls the block to be at level 21, the block is allowed to pass. Otherwise, the block runs into the obstacle and the game terminates. The obstacles become increasingly close together and the block moves to the right at a set pace. The score is given as the number of obstacles passed.

This mode is the most game-like mode offered by the system. The graphics as well as the competitive nature will keep users entertained. The educational nature of the system has not been compromised to achieve this increased entertainment value. The game still very much depends on users being able to answer math questions correctly and quickly. This mode is perfect for users who already know the answers to all equations and are solely working on increasing speed. Just one wrong answer terminates the game which encourages users to practice so they can improve. This mode can be seen as a treat for learning using the other modes. If a user has trouble at first with this mode and wishes to improve, they will be encouraged to go back to Learning, Flashcard mode and SpeedRun. While this game is not ideal for learning the answers, it provides an incentive for knowing the answers and uses fun as a motivator. An additional benefit of this mode is the visual element of the gap moving up and down which provides intuition into the relative size of numbers. As with SpeedRun, this game mode requires speed and increased physical activity.

IV. Hardware Components

This section describes all necessary hardware subsystems needed to create the final product.

A. Mat

The floor pad is the component of the project that the user actively uses to control what is happening on the display through a series of buttons used as inputs. The floor pad contains the pressure sensors that registers the input of the user stepping on them to interact with the display. The design of the floor pad, including the sensors, must be durable, reliable, workable, safe, and stay under budget.

The mat has a strong base of plywood in which all components are attached to and expand out of. Plywood is quite sturdy and durable, and it can also work effectively with tape to secure different types of components down. The size of the plywood needs to have enough space for each individually spaced-out sensor square for the user to interact with.

The sensors underneath the square need to have enough space so their connections do not touch, as that would prevent the sensors from working correctly, reducing the reliability of the floor pad. Following these specifications, a 36-inch x 36-inch cut of plywood was determined to be the best option, as this would leave a 12-inch x 12-inch space for each square's sensor. The 12x12 square for each sensor square is necessary as it allows the user enough space to step on each square with one leg while leaving enough room for the user's other leg to be in the neutral starting center square without any trouble or chance of falling due to misbalance, increasing the safety of the design. The height of the plywood was decided to be around ¾ inch as that would make the board sturdy enough to be repeatedly stepped on without breaking throughout multiple game sessions and continued use over time.

The board would be spaced out evenly creating a 36-inch x 36-inch grid to incorporate each of the 8 buttons with the center being the neural starting/standing zone surrounded by the other 8 squares of 12-inch x 12-inch. There are a total of eight buttons on the mat in all directions of the 3 x 3 grid --each button representing an action that the child can step on.

The pressure sensors consist of different layers of sheets made of conductive materials which cover all buttons. There is a wire going from each button's connection sheet to the microcontroller which reads when a connection is made between the connection sheet and the grounding sheet.

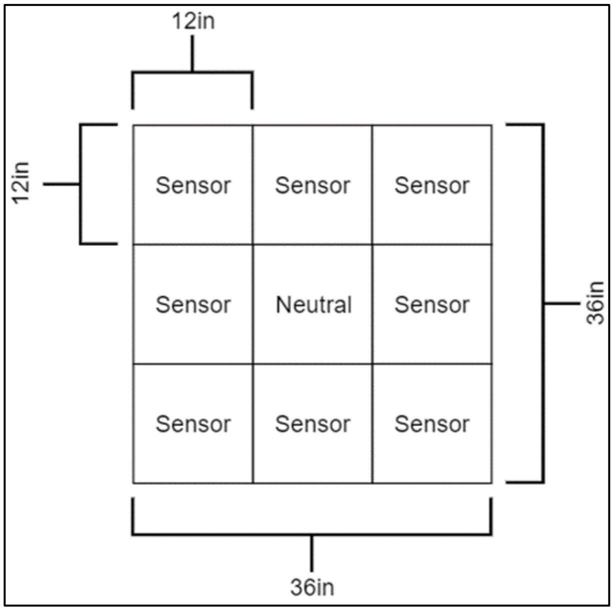

Fig. 2. Mat Design Layout.

B. Pressure Sensors

One of the main components of this project's design is the physical sensor setup which registers if the user is stepping on the designated target or not. This component is essential to a successful and operational project.

To ensure a successful final project, the design of the sensors must match the specifications of durability, reliability, workability, and safety. The design of the sensor must be durable to ensure continued support of the component through constant play of the users. This component design also supports the ability to withstand the amount of pressure and weight of any user who is using the project at that time. The design must be reliable. In this case reliability is determined by the correct number of times the user steps on the designated target with the sensor registering the step and delivering the appropriate data to the appropriate source. This is compared to the number of times when the user steps on the designated target and the step is not registered by the sensor. The design must be workable. In this case workability means that the design chosen must be able to be adjusted or changed without difficulty. A design that requires unreasonably specific tools to change different components of the design is not preferred as a more adjustable design provides more options for improvement of the overall project. It is also important to mention that the design must be workable in the way that it is accessible to reach and adjust with minimal difficulty at any time as a design that must be fully taken apart is not an effective use of time when building the full project. Therefore, a design must be workable in the fashion that it can be adjusted without overly specific tools or the dismantling of other parts. The design must be safe. Safety in this design includes checking the design for sharp or exposed edges that could present a possibility of injury in the form of slight scratch or something of a similar manner. The design must consider the safety of the user and remove all potential aspects of it that may cause injury. This aspect is important because during use, the user will be moving their feet around the project in a way that could catch corners or sharp edges unintentionally. The finalized project should be a fun and enjoyable experience for the user, not a potential chance for injury. With the base and partial layout of the design completed it's time to move on to the pressure sensors design plan. The design is for the entire 36-inch x 36-inch top of the plywood base to be covered in a layer of connecting tin or aluminum foil. The tin or aluminum foil is connected to the plywood base using electrical, duct, and double-sided tapes. This original layer of tin or aluminum foil is used as a ground for all the sensors, which allows for the device reading the inputs to register the input of the user stepping on the completed sensor. With the grounding sheet in place, the individual sensors for all 8 buttons can be created. Each sensor was created by using a layer of foam on top of the ground sheet for each square and then on top of the foam another layer of tin or aluminum foil as the place where current flows in from. The top sheet of aluminum foil is reinforced with duct tape over the top to prevent ripping. The foam has holes cut into it allowing the sensor to function. The sensor works by having the layer of foam hold the two sheets of tin or aluminum foil apart, then when the user steps on the foam the two sheets connect, allowing current to flow from the starting piece above the foam to the ground piece below the foam by the holes cut into the foam piece. The device reading for the inputs registers that current flows through the specific square and act accordingly by activating the intended input on the display allowing the user to interact in real time with the game through the floor pad. The foam needed was soft, strong enough to hold the tin or aluminum foil up, weak enough to be easily pushed down by the user, and springy enough to return to its original shape after continued use. The foam sheet for each of the squares fit into the 12-inch x 12-inch square for each designated sensor as well as cover enough space for the user to step on and have the input register with ease. With these specifications in mind, a 11-inch x 11-inch foam sheets was implemented. Within this 11-inch x 11-inch square, holes were cut for the sensor to activate. Many holes were cut for the easy connection while keeping up the structural integrity of the foam. Holes were cut into the foam in a consistent pattern. This design allows the user to easily step anywhere on the sensor square and have the response registered by the device reading for the inputs. This ensures reliability as the user can interact with the display and the foam has enough of it left to continuously return to its original state after repeated uses. Putting the design together, all eight sensors are built and in place. These components are secured down with electrical tape as it holds the design together and is non-conductive, which won't affect the current flowing through the sensor. After everything was taped down, the wires were connected. The design has one ground sheet at the bottom and needs only one ground wire. The rest of the wires are 8 input wires connected to the device reading for inputs. These wires measure the voltage of each sensor square and register when there is a change such as when the user steps on the sensor square connecting the circuit to ground. The wires run through the floor pad meeting up towards to top center where they connect to the device sensing for inputs. The wires are connected to the floor pad using electrical tape since this is an easier method than soldering as there is less of a chance of a mistake, as well as it allows easy changes with just the removing of the tape needed. However, connecting the wires to the device reading for inputs requires solder as each input pin needs to separate from each other to have good reliability and have each sensor square affect only the intended target. After the full floor pad is completed, the only thing left is a casing that goes over the pad to allow the user to step on the floor pad without directly touching any of the internal components. This task was achieved by covering the entire top and bottom in a tarp like material in a way that it covers the bottom of the floor pad and folds up from the north side to fully cover the entire top of the floor pad. This design allows easy access to the components while also making sure no components slip out or are accidentally snagged on anyone or anything.

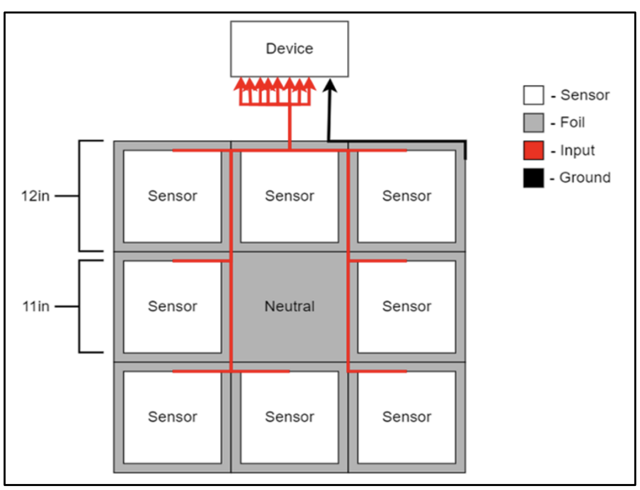

Fig. 3. Dance Pad Wiring.

C. Printed Circuit Board

The printed circuit board was designed using the Autodesk EAGLE software. The components necessary for our design were determined and their footprints downloaded from Ultra Librarian. As ours is a simple application, the only components necessary are an MCU, USB to UART converter, USB connector, and the basic components (resistors and capacitors) necessary to make the others function. The PCB also includes through holes in which each pad top is wired to. Connections between components were determined by the manuals of those components. The circuit board design was sent to JLCPCB for manufacturing.

V. Software Components

The programming efforts for the development of Math Math Computation are divided into two main tasks: reading input data from the user as they step on the buttons of the mat and feeding that data to the Python game running on the computer that displays the instructions, menus, and options. It is imperative to accurately read the data coming from the pressure sensors with little to no delay. These readings are the input data that the game uses on the display device. This section depicts all necessary software subsystems needed to create the final product.

A. Microcontroller

The microcontroller is one of the main subsystems of Math Math Computation. One of the most common applications of microcontrollers is to be used in low-cost embedded systems that acquire analog signals, to then change them to digital values, and finally process the collected data so it can be transmitted to (and perhaps displayed on) another system. The microcontroller present in the system needs to do something very similar: it reads signal inputs from the pressure sensors (by detecting voltage change in its pins) and sends them to the display system. In this case, the signal inputs are voltage readings that are interpreted by the microcontroller as "high" or "low" values, and then transmitted to the display system.

The microcontroller chosen for this project is the Atmega328. The main reason this MCU was chosen was because of its current availability on the market and because of its easy use.

For testing purposes during the developmental stages, the Arduino Uno Rev3 board was selected since it uses the Atmega328p MCU. This board later got replaced by a custom printed circuit board designed specifically for Math Math Computation. For the interaction with the Arduino Uno Board, Arduino IDE is used, and the Arduino programming language is the high level programming language used. In this stage, the main goal from a software perspective is to read the data coming from the pressure sensors as input signals and feed those signals to the PC (or laptop), which identifies the data coming from the serial port.

The Atmega328 was programmed using a breadboard. A small circuit containing components such as the MCU, resistors, capacitors, and a 16MHz crystal oscillator was created in order to upload an 8MHz bootloader to the chip. With the 8MHz bootloader, the chip could now function on the PCB without the addition of a crystal oscillator. Once the chip had the bootloader installed, a new circuit was constructed for the purpose of flashing the code to be ran. After connecting the USB to Serial Converter module of the Arduino Uno to the chip on the breadboard, the sketch was uploaded to the Atmega328. This sketch identifies voltage change in 8 of the pins of the MCU and sends a unique string (for each of the pins) to the computer.

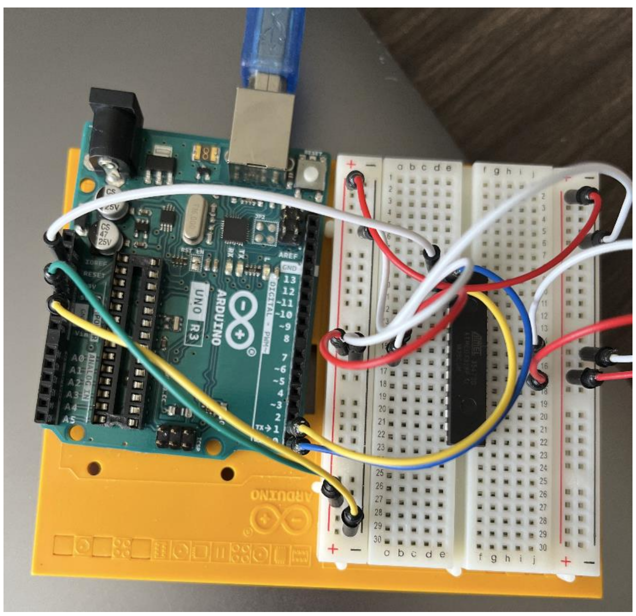

Fig. 4. Arduino (Atmega328) on a breadboard.

B. Python application

Python was the selected programming language to develop the video game component. The main reasons behind this decision were to use the PyGame module, which is a free and open-source library that offers a plethora of free examples and tutorials, and because Python is a very user friendly language which would allow all team members to contribute if necessary. To establish the communication between the Atmega328 and the Python game, PySerial library was used to support the serial connection between the two components.

Once the connection is secure, the PyGame module is initialized, and the main menu is established. The program simply waits for inputs to be sent from the microcontroller, which it uses to navigate the menu and select an option. Upon selecting an option, the screen wipes the current menu so as not to have extra Surface objects lying around, then immediately populates the screen with the next menu. On all menus other than the main menu, there is an option to move to the previous menu, the main menu simply has an option to quit the game.

Upon reaching the menu before a game or practice, some options are available for the user to select. Once the users press start on the game, the options are saved and utilized in the actual game state. These options persist until the user eventually chooses to go back to the main menu. If in SpeedRun or Mind the Gap, the user has a score at the end of their game. To save these scores and later retrieve them for the leaderboards, the built-in package in Python "json" was implemented.

One of the main goals and motivations for Math Math Computation is to provide students with an engaging and fun tool to learn math. Therefore, given that the target audience are young children, developing an appealing and entertaining user interface is critical. For the initial design and to create illustrations of what our game looks like, we are using wireframing tools like Figma as well as other tools like Microsoft Power Point. Design basics such as input controls, navigational and informational components, containers are all handled by PyGame. All interactions and animations were also be chosen from the mentioned library.

When creating a game that is targeted at young children, users can easily get distracted therefore the complexity of the graphical user interface plays a big role in maximizing the attention span of our target audience. Size is also an imperative element of the desired system. All buttons and texts are of reasonable size for children to clearly see. The fonts used are consistent and easy to read. For color schemes, the selection was based on the effect of colors. Sound effects play an important role as well. They attract and hold the children's attention. However, since this game is designed to be played in the classroom, the background music is not loud or distracting.

To navigate to the various games and options, a menu-based approach has been selected. Users use the left and right arrow pads to navigate the menus and select an option using the "Enter" pad, which is denoted by a visual indicator showing which item was currently selected. The decision was made to have navigation done via the dance pad as the action of either moving between the computer and pad or keeping the computer withing arms reach of the pad was considered undesirable and a slight safety hazard in either case. Using the dance pad for navigation does mean the users are farther from the display, so having large and clearly visible graphical elements is key for user enjoyment. To prevent clutter on the main menu, the various non-practice mode games were put into a sub-menu "Play Menu." This also has the added benefit of being supportive of other game modes that could be added. Upon selecting a game, an options screen is displayed before confirmation to play the game. Here, the user can select which of the subjects they would wish to play, with options for addition, subtraction, multiplication, or division. Included in this menu and all others is the option to return to the previous menu.

In the Speed Run game, several UI elements tell the player all the information that they may need. On the peripheries are the current user score, the time remaining, and the controls for the game. The placement of this information is important for several reasons. Each bit of information is in a separate location so that the user knows that when they look at the top right, they find the time, and not accidentally confuse it with the score. The size of the information is relevant as well, it must be large enough to understand at a moment's glance, but not large enough to distract from the most important information, the question and answer in the center screen. Finally, the color of the outside information is also muted to draw less attention away from the question and answer in the middle.

In the Mind the Gap game, some of the UI elements are unique to the other games in that their location is dynamic and changes due to user input or the game logic. The two elements that remain static are the user score, and the controls, once again located on the peripheries to keep the focus on the game in the center. Whereas in the Speed Run game mode, the user answer was in a static field, the user answer moves the input box up or down in relation to its value. The bottom of the screen corresponds to a value of 0 and the top of the screen shifts depending on the problem type chosen (addition, subtraction, multiplication, etc.). The problems the user needs to address comes from the right side of the screen and move towards the left, where the user answer is. The problem is in a gap between two bars. By the time the bars reach the user answer, the value of the user answer must be equivalent to the value of the expression or else the input box hits the bar and the game is over. It should be noted that if a user inputs their correct value before the bar arrives, they must wait unit it passes before they can address the next one. Problems start to arrive in more frequent intervals as the game progresses.

Selecting practice from the main menu takes the user straight to the practice mode sub-menu. Practice mode games differ from those under Play Mode in that they are not designed for execution and competition. Practice mode games are designed to help teach and learn the math with minimal stress. There exist two practice modes: FlashCard Mode and Learning Mode.

Both practice modes have the same game options available, being able to choose a desired operation as well as a focus number to work with. Both games are very similar to SpeedRun; however, the score and time limit are removed in these game modes as Practice Mode is not intended for competitive play but rather for stress free learning. The problem is displayed on the screen along with a box that updates a value in real-time based on the user's input. Additionally, the controls are located at the bottom left of the screen, so that the user does not need to constantly look down at the pad to know what to do. The controls are also muted so as not to be too distracting from the question. In the case of Learning Mode, this would remain the same but include the answer in the input box until the user starts to enter a value.

VI. Realistic Design Constraints

Many constraints had to be taken into consideration while designing this product. These constraints included economic, time, design, social, safety, and health considerations. Some of these constraints came from the team's particular situation, such as the economic constraints of self-funding, and the time schedule of senior design. Others delt with the real-world considerations of safety, social settings, health, and standardized designs. Economic constraints played a large role in the development of this project as the project is entirely self-funded. The goal was to complete the project as cheaply as possible without compromising quality. The economic constraint discourages trial and error as a method of selecting components because that would require purchasing more components than strictly necessary. Extensive research was done before any component was purchased to increase the odds that said component worked and wouldn't have to be repurchased or replaced. This project is to be completed by the end of Senior Design II Summer 2022. This strict and tight deadline limited options, especially on the software side where more advanced features such us mobile development were not part of the final design. An additional constraint brought forth by the educational setting is sound disturbance. If the system is to be implemented in a classroom it needs to be quiet enough to not disturb other students. If the mat is to be used in a classroom setting it is important that the system is as compact as possible. The target audience for this product is children, so every effort must be made to ensure safety. A metal frame is not suitable for use by small children, and it would provide a very hard surface and sharp edges. A wooden or plastic frame covered in suitable tarp will be used instead to deter injuries. All wires must be properly attached, concealed, and coated to prevent the risk of electrocution. All electronic components must be secured away to prevent users from accidentally stepping on or otherwise interacting with them. The physical nature of using this system leads to the health risk of over exertion. Users must be told to stop or take a break if they become lightheaded or short of breath. It is difficult to impose measures to mitigate this risk because much of the system use is self-paced. It will be the responsibility of the user and their guardians to prevent overexertion.

VII. Conclusions

Math Math Computation is a tool that will be used to teach elementary aged children math skills. These skills include the ability to add, subtract, multiply, and divide numbers up to the value of ten. Inputs into the system will be read via buttons on a wooden mat that add one or ten to the user’s input value. This repeated motion will add a component of exercise as well as helping the child memorize the answers by using a physical action. Throughout the design process the goal of having the product easily accessible to our target demographic was kept in mind. The four different game modes will allow the opportunity to learn, practice, and master mathematical memorization problems. Bright graphics and simple language will be utilized to keep children engaged and ensure they understand what is being asked of them. Safety precautions were taken into account during the mat design process. It is the hope of this group that this product can be utilized by elementary aged children and help them learn mathematics in a way that is more fun and less frustrating than traditional classroom methods.

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The Engineers

Helen Diaz is a 22-year-old Computer Engineering student at UCF. Upon graduation, Helen will work for Deloitte US as a Solution Analyst. To further her studies, Helen plans to return to UCF to pursue master’s degree in cyber-security and privacy.

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Sarah Schiefelbein is a 22-year-old Electrical Engineering student at UCF. Upon graduation, Sarah will continue her studies at UCF and pursue a master's degree in Electrical Engineering.

Nick Habryl is a 22-year-old Computer Engineering major with a minor in mathematics. After graduation Nick hopes to find work as a software engineer or game engine developer. Nick plans to give back to the community by helping teach others about engineering.

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