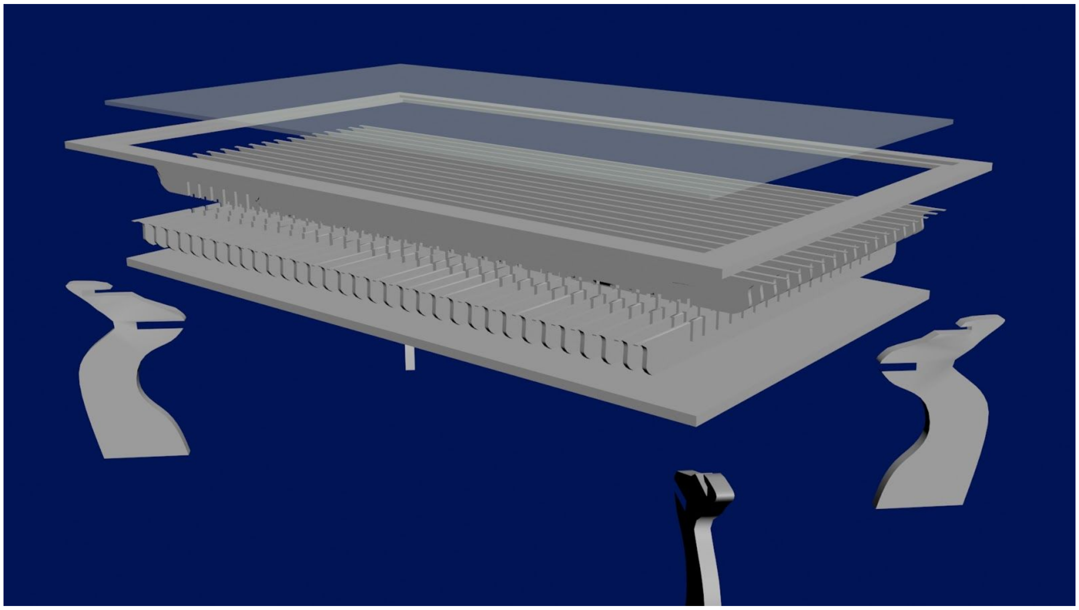
UCF Senior Design I

Smart Table Interface



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Initial Project Document and Group Identification
Divide and Conquer

Group 34

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Project Narrative

This project is to design a table that would have a moderately sized matrix of individual cells on the top that would act as pixels. Each so called cell would consist of an RGB Led to produce any given color value which would likely be achieved through pulse width modification. Each cell would also have a LED driver that would act as a slave to a main microprocessor on another main board. Located in the specifications below is a detailed list of functionality to be included in the project. Timekeeping, environment sensing, receiving weather information from the internet, and playing various games such as “Snake”.

This device will not necessarily be designed with inherent market value in mind. The device will have relatively cheap production cost, however the primary motivation for designing the product is simply as an academic exercise in an effort to improve the member’s understanding of integration across various subsystem. This is a proof of concept design that has potential to extend into the market in future renovations, if a highly practical concept is prepared.

One form of interactions will be through an application that will be developed to stream data to the table and provide an interactive interface for the user in addition to physical tactile feedback in the form of buttons embedded on the table itself. This will provide a higher entertainment value for the end user, as such is something that is not directly quantifiable.

The device will be supplied from mains supply, plugging directly into the wall. This voltage will be transformed down, then rectified and regulated to acceptable values for the processing units and RGB light generating units. The physical space of the power supply on the board will be at a relative minimum, with heat sinking of the parts, if required, taking up an appreciable fraction of space.

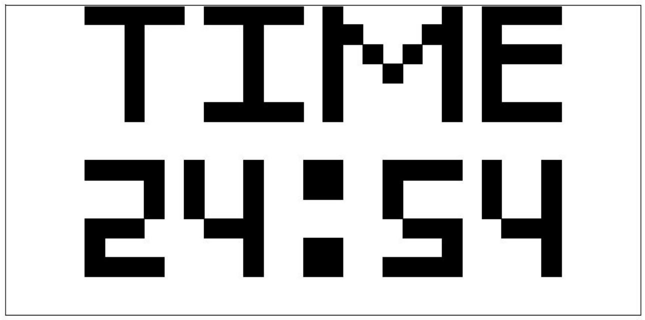
The total size of the table will be relatively large, based solely on the scope of the display. For any relative resolution that we require, we will need a decent amount of physical size to display the information to. There will be a minimum of 256 individual pixilated cells found on the device. Each cell will include an RGB LED and controlled by an led driver in relative proximity. The dimensions of the pixelated matrix should be at minimum 8 by 16.

The device will have a robust feature set. Found in the specifications section below is the list of functionality provided for our device.

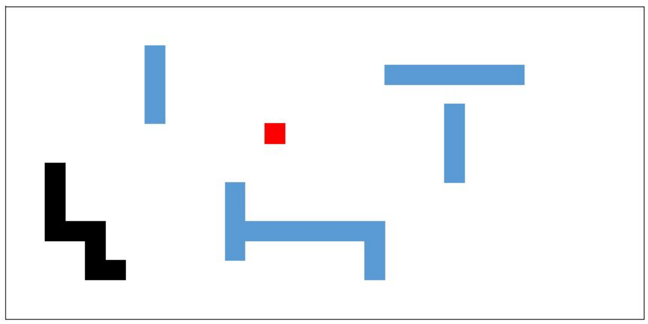
Project specifications

- Physical table
  - Should be no larger than 4ft long by 8 feet wide by 4ft tall
  - Should be structurally sound, holding at least 25 lbs total weight
  - Constructed out of wood primarily, with a plexiglass cover over the cells
- Single microcontroller to run the device.
- Minimum 256 individual pixels will be located on the display
- Several auxiliary devices/functionality will be included
  - Phone charging port(s)
  - Temperature sensing
  - Bluetooth connectivity
- Software functionality
  - Project various animations for startup, loading, and other transitions
  - Timekeeping functionality
    - Clock, timers, alarms
  - Reading from ambient pressure/temperature sensing
  - Play various games
  - Grab weather data from phone to display (figure 3 below)
  - Minimum 15 Hz Refresh Rate
- 24 VAC input to board to be transformed
- Production cost of under $1,000
  - Majority of price is board fabrication, surface mount devices are relatively cheap

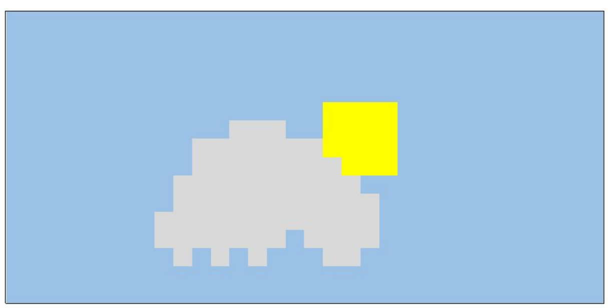
Examples of runtime output



(1)



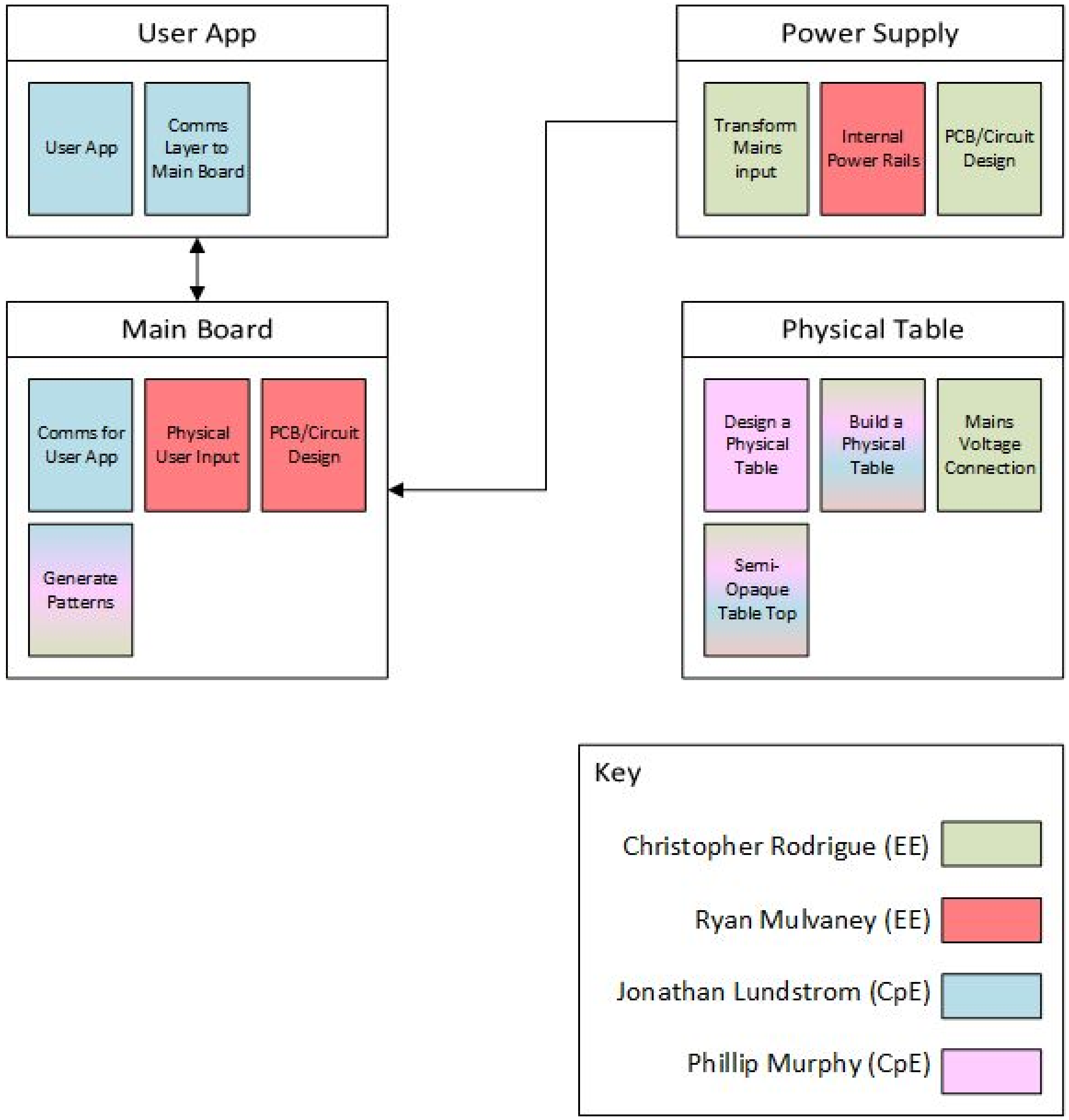
(2)



(3)

Above are examples of potential displays while the table is executing code and pushing information to the led matrix. (1) is an example of the device outputting time to the display. (2) is an example of an instance of snake being played on the micro. (3) is an example of a weather reading by the device, the current weather is grabbed through an internet service, analyzed, then a pre programed animation will play depending on the weather. In this case the weather outside is partially cloudy.

Block Flow Diagram



Initial Project Milestones

House of Quality

			Engineering					
			Structural Integrity	Dimensions	Power Mode	Heat Generation	Refresh Rate	Cost
			(+)	(-)	(+)	(-)	(+)	(-)
Market	Interactivity	(+)	↑				↑↑	↓
	Functionality	(+)	↑			↓	↑	↓
	Style	(+)		↓			↑↑	↓
	Ease of Use	(+)		↓				↓
	Resolution	(+)	↑	↓↓	↓	↓↓	↓	↓↓
	Power Efficiency	(+)			↑↑	↑	↓	↓
	Cost	(-)	↓	↓↓	↓↓	↓	↓↓	↓↓
			25 lbs	8ft x 4ft			15 Hz min	$1000 max

↑ = Positive correlation
↑↑ = Strong positive correlation
↓ = Negative correlation
↓↓ = Strong negative correlation
+ = Positive polarity , positive effect on project quality
- = Negative Polarity , negative effect on project quality

The market parameters are qualitative in nature and are focussed on the elements of the project that usually influence an individual to purchase a device. Interactivity is a measure of how engaging the device is, and style is a measure of the furniture's appearance. Ease of use is an important market parameter because it defines the overall accessibility of the device from a non-technical standpoint. Using the device should feel intuitive and simple while maintaining functionality, which is yet another parameter taken into consideration when purchasing a new device. For the more informed consumer, more technical market parameters are considered when purchasing a new display. There is a trend towards displays with high power efficiency, high resolution, and low cost.

The engineering parameters of the project are quantitative in nature. The structural integrity of the table is an obvious inclusion to this list, and addresses how much weight the table can support since that is the principle function of the device. Relatedly, the dimension of the table is another engineering attribute that has a significant effect on the total cost of the project. Electrical parameters relevant to any display technology are refresh rates, heat generation, and power modes. Ideally, the device will have a comfortable refresh rate, generate an insubstantial amount of heat, and include power modes that will minimize overall power usage and the cost of maintaining the device.

Budget

	Est Amount	Est Quantity	Est Total
Indiv Contribution			
Christopher Rodrigue	$1,000	1	$1,000
Ryan Mulvaney	$1,000	1	$1,000
Jonathan Lundstrom	$2,000	1	$2,000
Phillip Murphy	$0	1	$0
Subtotal			$4,000
Parts			
Prototype Boards	$20	12	($240)
Main Microcontrollers	$15	1~3	($45)
RGB LED	$0.10	512~1024	($110)
PCB Boards	$300	1	($300)
Capacitor/Resistor	$0.01	5,000	($50)
Table Cost	$250	1~2	($500)
Subtotal			($1,245)
Total			$2,755

This project will not be backed by any sponsors; as such, each group member will pledge the dollar value that they are willing to contribute to the overall cost of the project, which can be seen in the table above. The tabularized values represent maximum individual contributions to the project. It is anticipated that the overall cost of the project will not exceed $2,000.00 USD. The values depicted are non-binding estimates.

It is expected that the majority of the cost of the project will be spent on PCB manufacturing. Miscellaneous SMD components, such as the RGB LEDs, LED drivers, resistors, and capacitors can be purchased in bulk quantities for relatively low dollar values (LDV). It is noteworthy that

• TI LED Table

the cost of the components is directly proportional to their quality, so this fact must also be taken into consideration when conducting a cost-benefit analysis of hardware assets.

Software assets are expected to have zero dollar value (ZDV). This is due to the fact that the project will primarily incorporate free or open source software.

References

- TI LED Table

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