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introducing

FASM RYB Color Mixer

ASM

SOLUTIONS

Outline

- Product Overview
- System Overview
- Hardware
- Software
- Business Aspect
- Complications
- Timeline
- Future Development
- Conclusion
- Questions
- Acknowledgements

Product Overview

FASM RYB Mixing Device

Motivation

Problem

- Lack of accessibility to desired color for painters.
- Limited mobility of color mixing devices.
- Time consuming ordering process.

Solution

- FASM RYB paint mixer.

Existing Products

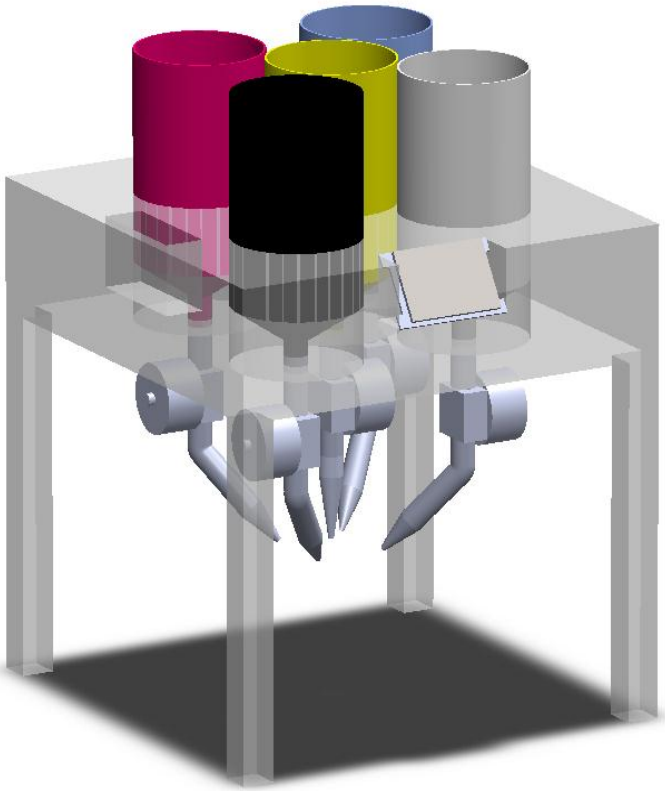
Advantages

- More accurate in color range
- More economical in high scale mixing

Disadvantage

- High purchasing price
- lack of portability
- High maintenance cost

Our Product



Advantages

- Small dimension
- Easy to use device
- Portable
- Accurate result
- Environment friendly
- Affordable

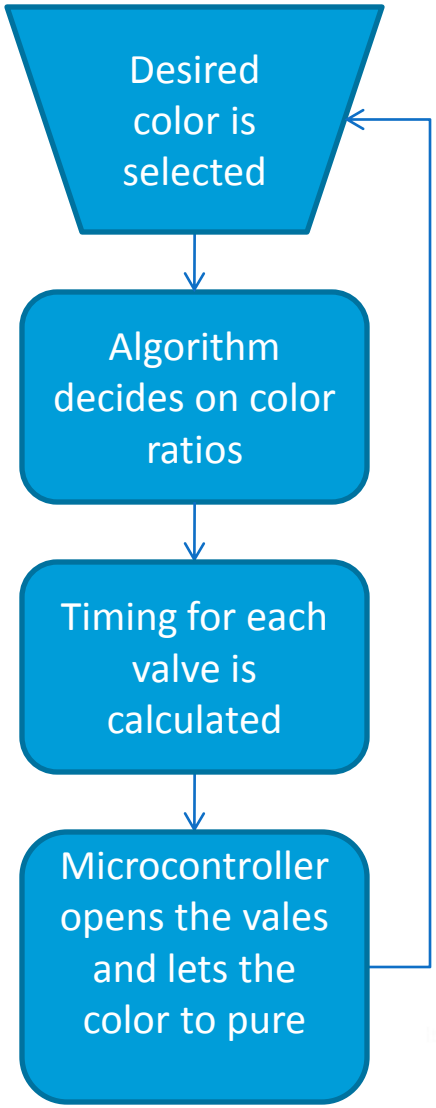
2 System Overview

FASM Color Mixing Device

System Overview

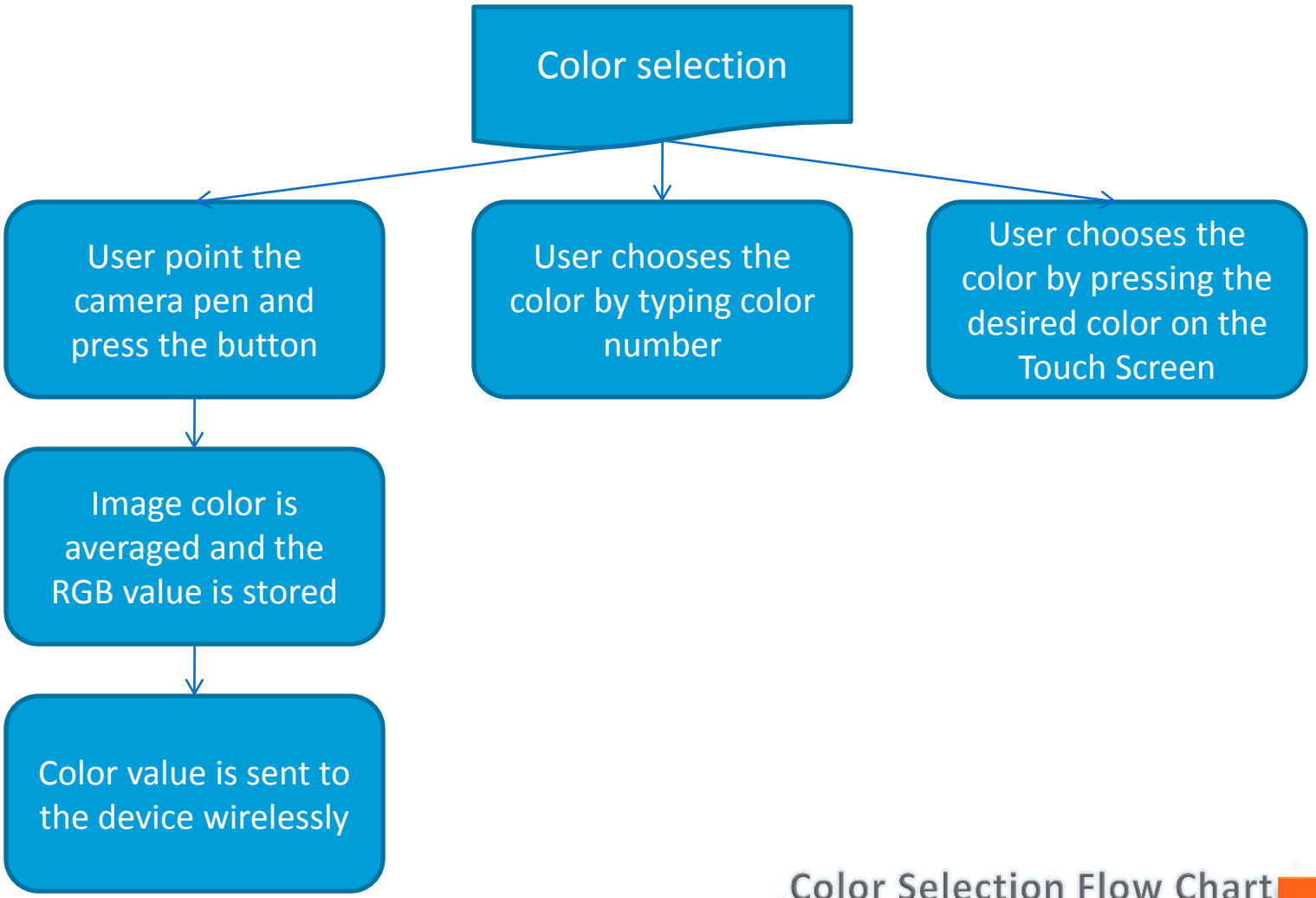
- User inputs a color wirelessly or through a touch screen.
- Systems converts RGB values to RYB color ratios.
- LCD displays the currently dispensing paint.
- Values open to dispense the paints.
- User mixes the paints to get the desired paint.

System Overview



RYB Mixer Flow Chart

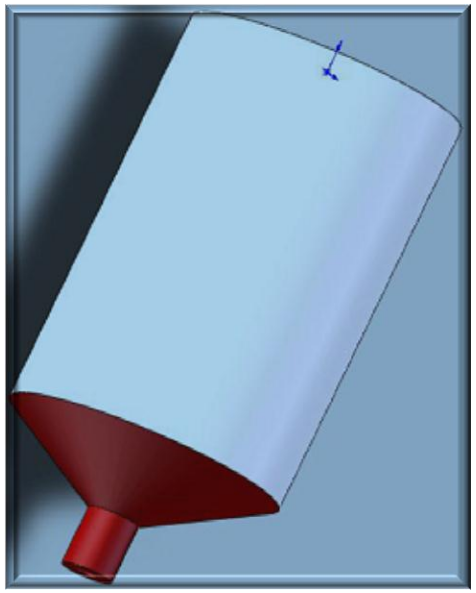
System Overview



Color Selection Flow Chart

Hardware

Components

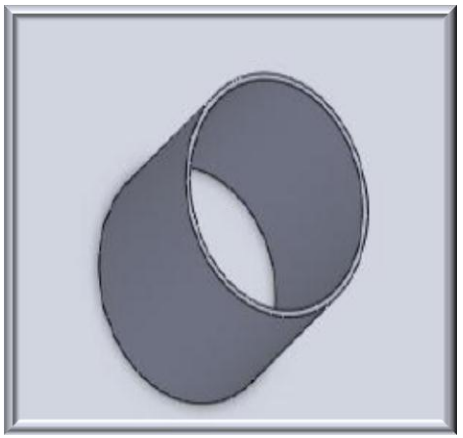


Gravity Cup

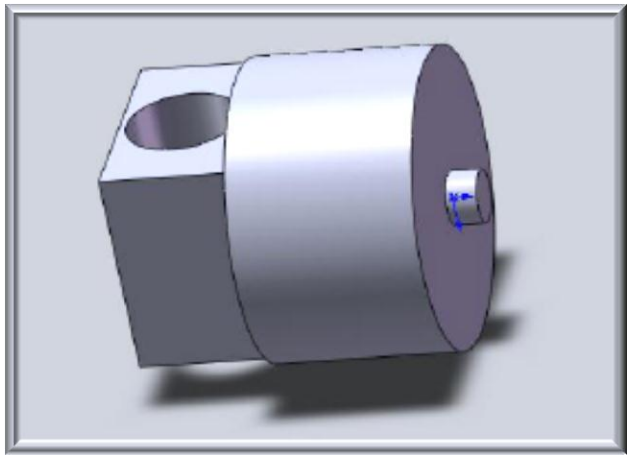
- QUANTITY : 5
- Capacity 1000 ml
- Covered with snug fitting press fit lid
- Made up of Aluminum
- Rust free

Connector

- Quantity : 5
- Material : Stainless steel
- Connects Gravity Cups to the Solenoid valves



Components

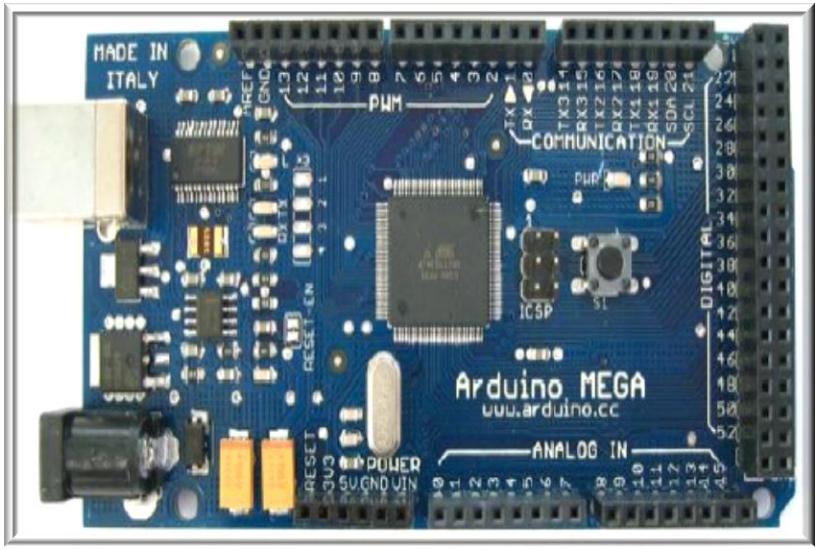


Solenoid valve

- Model : 2W-040-10
- Quantity : 5
- Controls the paint flow.
- Operating voltage : 45 Volts.
- Mosfets (IRF510) turn the valves on/ off .

Arduino Mega 2560

- Main part of control system.
- Controls the touch screen, valves, LCD display
- Allows to use color mixing algorithms.
- Flash memory 128 KB.



Components

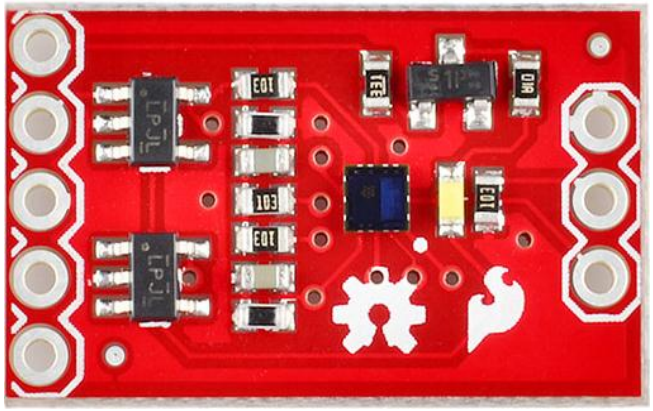
Arduino Uno

- Controls the wireless pen.
- Prepares the sensor values and transmit the data to the receiver.
- Digital i/o pins: 14
- Flash memory 32 KB

Touch Screen

- Model: ezlcd-002
- Gathers the user input.
- Sends the color values to the microprocessor, which open the valves.

Components



Color Sensor

- Model: Avango adjd color light sensor
- Senses the RGB values of the surfaces
- Operating voltage : 2.5 v
- Connected to Arduino UNO

Receiver

- Model: WRL-10533
- Operating voltage: 5 Volts
- Baud rate 4800 bps
- Range: 500 ft

Components

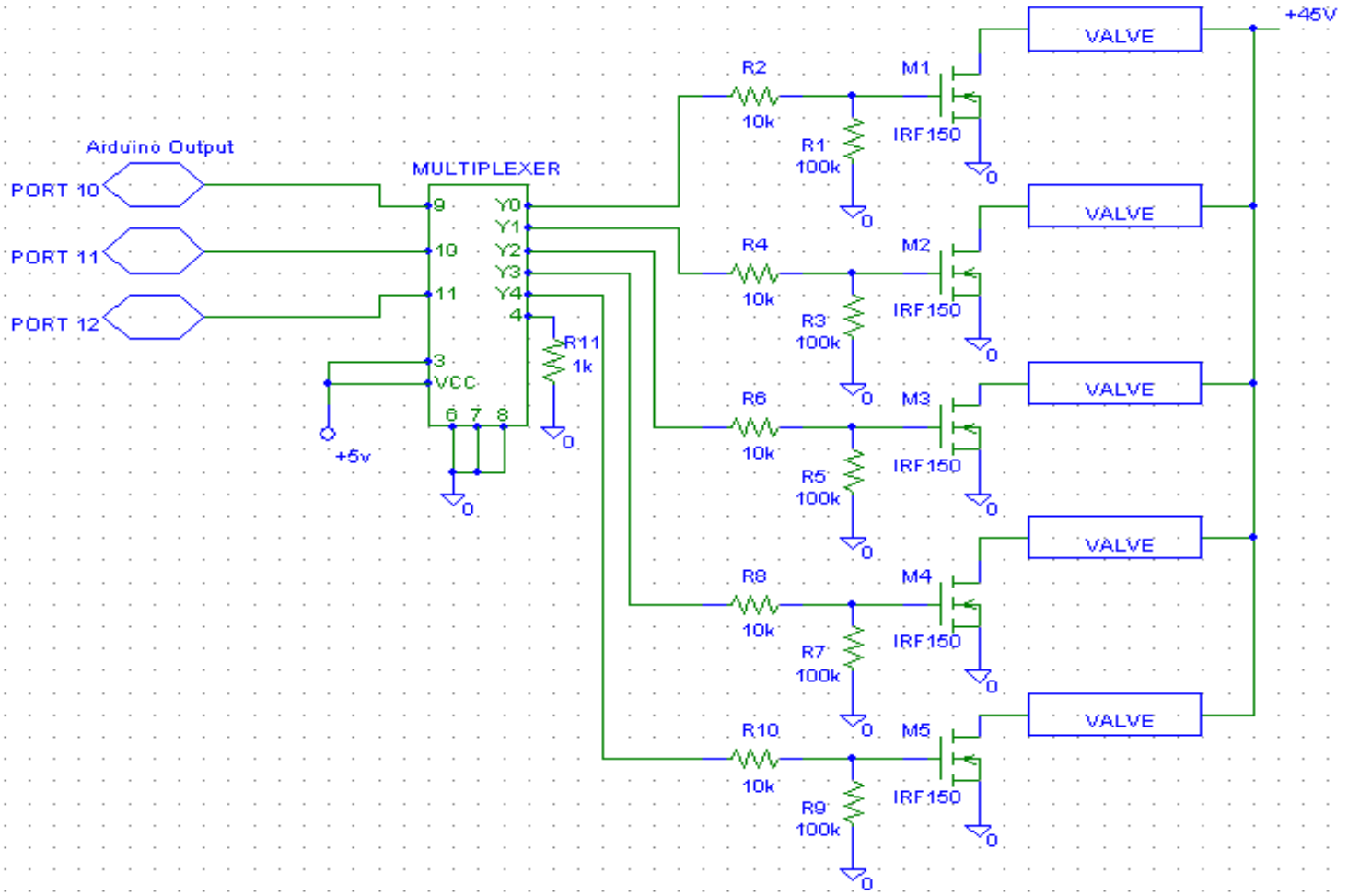
Transmitter

- Model: WRL-08945
- Transmission frequency: 315 MHz
- Operating voltage: 5 VOLTS
- Baud rate 4800 bps
- Range 500 ft

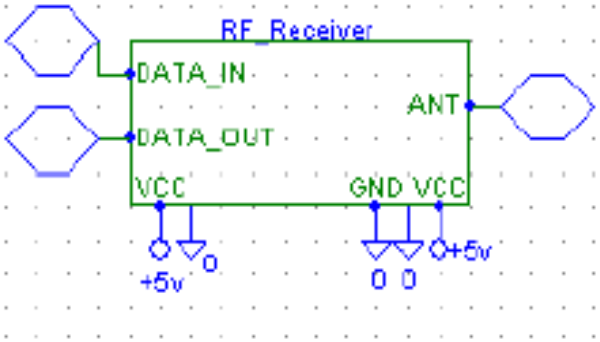
Power Source

- Connected five 9 volts batteries in series
- Powers the valves, and Microprocessors
- Portable

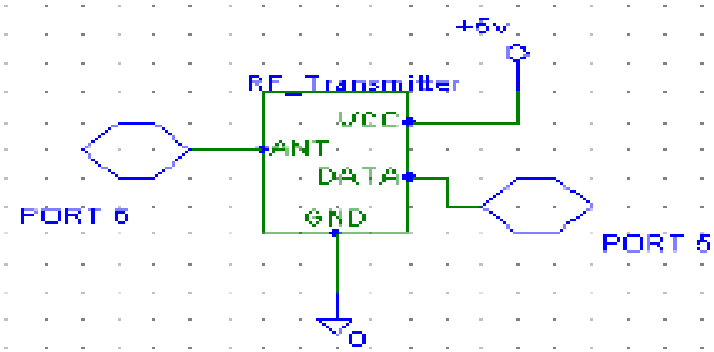
Valve Control Circuit



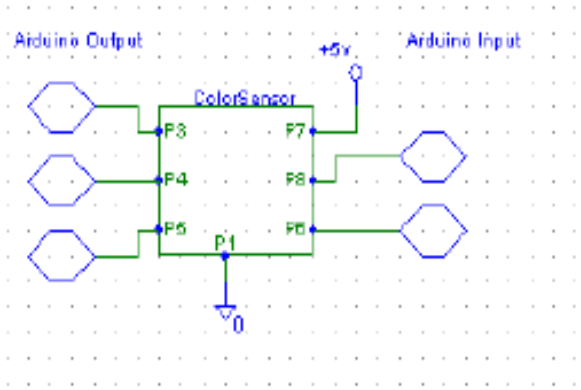
Circuit Design of Wireless



RF Receiver



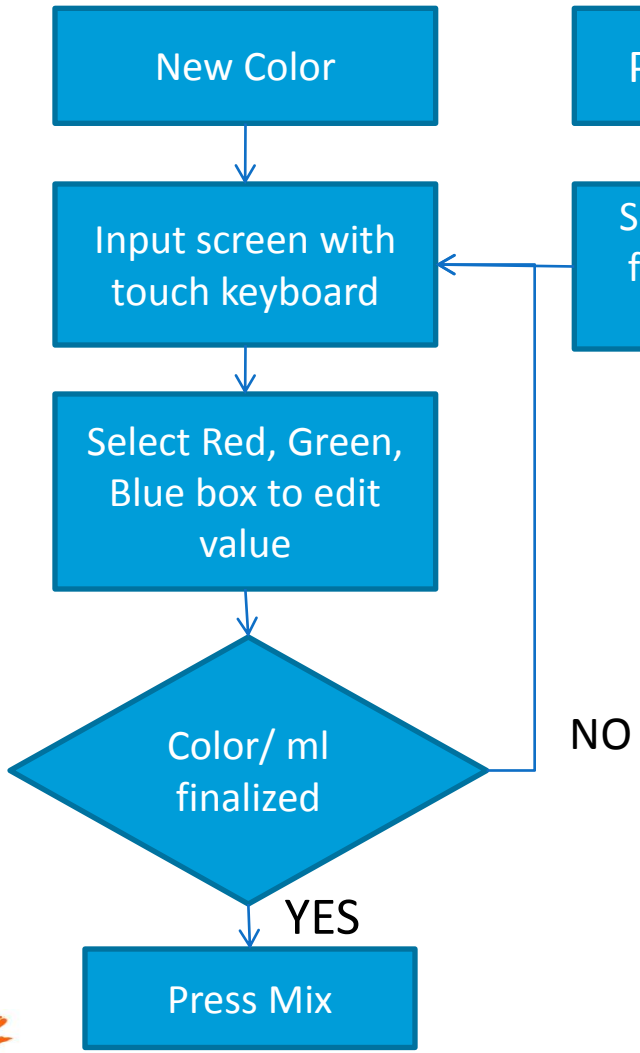
RF transmitter



Color sensor

4 Software

Touch Screen User Interface



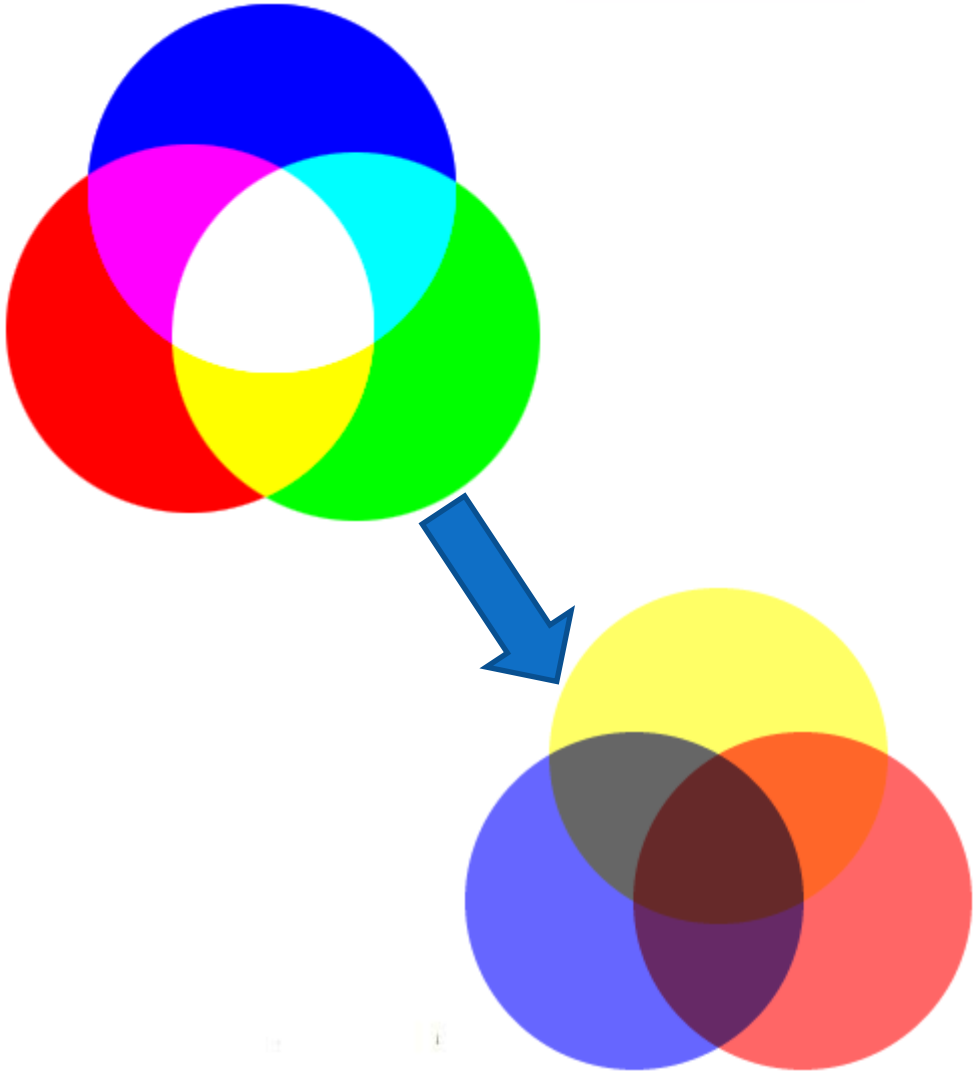
RGB Conversion

Read R, G, AND B Values

Convert from 8 BIT to float

Apply values to formulae

Adjust resulting ratio for volume (ml) chosen by user

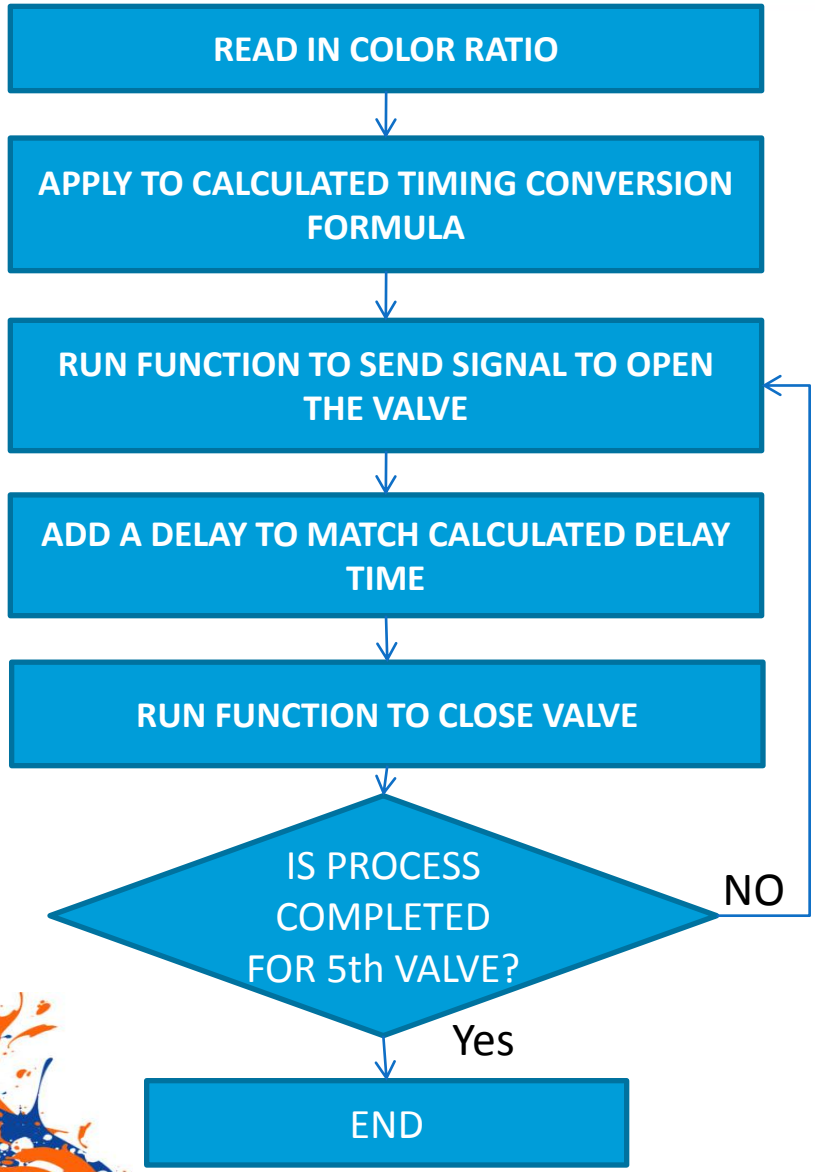


RGB Conversion

Formula

- RGB is additive.
- Everything we see is subtractive.
- Need to change RGB into a new form for the paints.
- Mixture of RYB conversion with Black and White for the contrast.

Valve Control Algorithm



Wireless Algorithm

Transmitter

- RGB values are read from the sensor.
- Values are compressed into a single long integer.
  - Final Value = $R + (G \times 255) + (B \times 255^2)$
- Checksum is made based on the final value
- Checksum and the value are sent using the RF transmitter

Wireless Algorithm

Receiver

- System is constantly checking for a wireless signal until the correct start value is received.
- Checksum can be used to make sure of the validity of the values.
- Final received value is decrypted.
  - R = (v%255)
  - G = (v/255) % 255
  - B = (v/255^2) % 255

Business Aspect

FASM RYB Mixing Device

Prototype Expenditures

Budget

- Estimated budget: $1400
- Actual budget: $670

Primary Source of funding

- ESSEF - $500
- FASM Solutions - $170

Cost breakdown

FASM Solutions

Vancouver, Canada

Product ID	Description	Seller	CA Price	Quantity	Tax	Shipping	Total
Touchscreen	TFT Resistive Touch Screen	ESSEF Loan	-	1	-	-	-
Arduino Uno	Microprocessing Unit	CanaKit	$ 29.95	1	$ 3.59	-	$ 33.54
Plastic Baster	Paint syringe for trials	Dollar Store SFU	$ 1.25	3	-	-	-
Sewing organizer	Plastic holder to test paints	Dollar Store SFU	$ 1.30	1	$ 0.63	-	$ 3.88
Gravity Cups	Paint Holders	NTXTods.com	$ 9.79	5	-	$ 37.25	$ 86.20
Battery	9V Alkaline	R.P Electronics	$ 3.29	1	$ 0.39		$ 3.68
DBM-09	9 PIN D-SUB Male	R.P Electronics	$ 1.35	1	-	-	-
US-928	Mini USB 2.0 5POS Conn	R.P Electronics	$ 3.95	1	-	-	-
310-645	2.1 Plug - 9V Clip	R.P Electronics	$ 3.30	1	-	-	-
310-513	2.1 Jack - 1.3x3.5 Plug	R.P Electronics	$ 2.60	1	-	-	-
110-305-5	LED 3MM GRN 4-18MCD	R.P Electronics	$ 1.69	1	-	-	-
110-504-5	LED 5MM YLW 4-30MCD	R.P Electronics	$ 1.69	1	-	-	-
110-502-5	LED 5MM RED 1.8-5.0 MCD	R.P Electronics	$ 1.49	1	-	-	-
30-11410	TACTILE Switch 5Pcs	R.P Electronics	$ 4.20	1	-	-	-
425-8	Desolder Braid 2.9mm 1.5M	R.P Electronics	$ 2.89	1	-	-	-
SR-360	Solder Pack Lead Free SIL	R.P Electronics	$ 3.70	1	$ 3.22	-	$ 30.08
Paints	Water based paints	Home Depot	$ 13.97	5	$ 9.79	-	$ 79.64
Valve	3/8" Solenoid valve	Ebay	$ 9.95	5	-	$ 26.95	$ 76.70
Avago sensor	Color light sensor	Sparkfun	$ 4.95	1	-	-	-
Header kit	Arduino Stackable	Sparkfun	$ 1.50	2	-	-	-
Shield	Arduino Protoshield kit	Sparkfun	$ 16.95	1	-	$ 26.79	$ 51.69
Sensor mount	Color sensor mount kit	Sparkfun	$ 14.95	1	-		$ 40.00
Wood	Hayman Panels 24x48"	RONA	$ 4.96	2	$ 1.19	-	$ 11.11
Mounting Tape	Tape	Home Depot	$ 2.98	1	$ 0.36	-	$ 3.34
Nails	Nails set	Home Depot	$ 4.19	1	-	-	-
d21	d21	Home Depot	$ 1.50	2	-	-	-
Lumber	Lumber cut	Home Depot	$ 2.00	1	$ 1.10	-	$ 10.29
Total Inventory Value			$ 260.25	65	$ 37.30	$ 90.99	$ 670

6 Complications & Difficulties

Complications

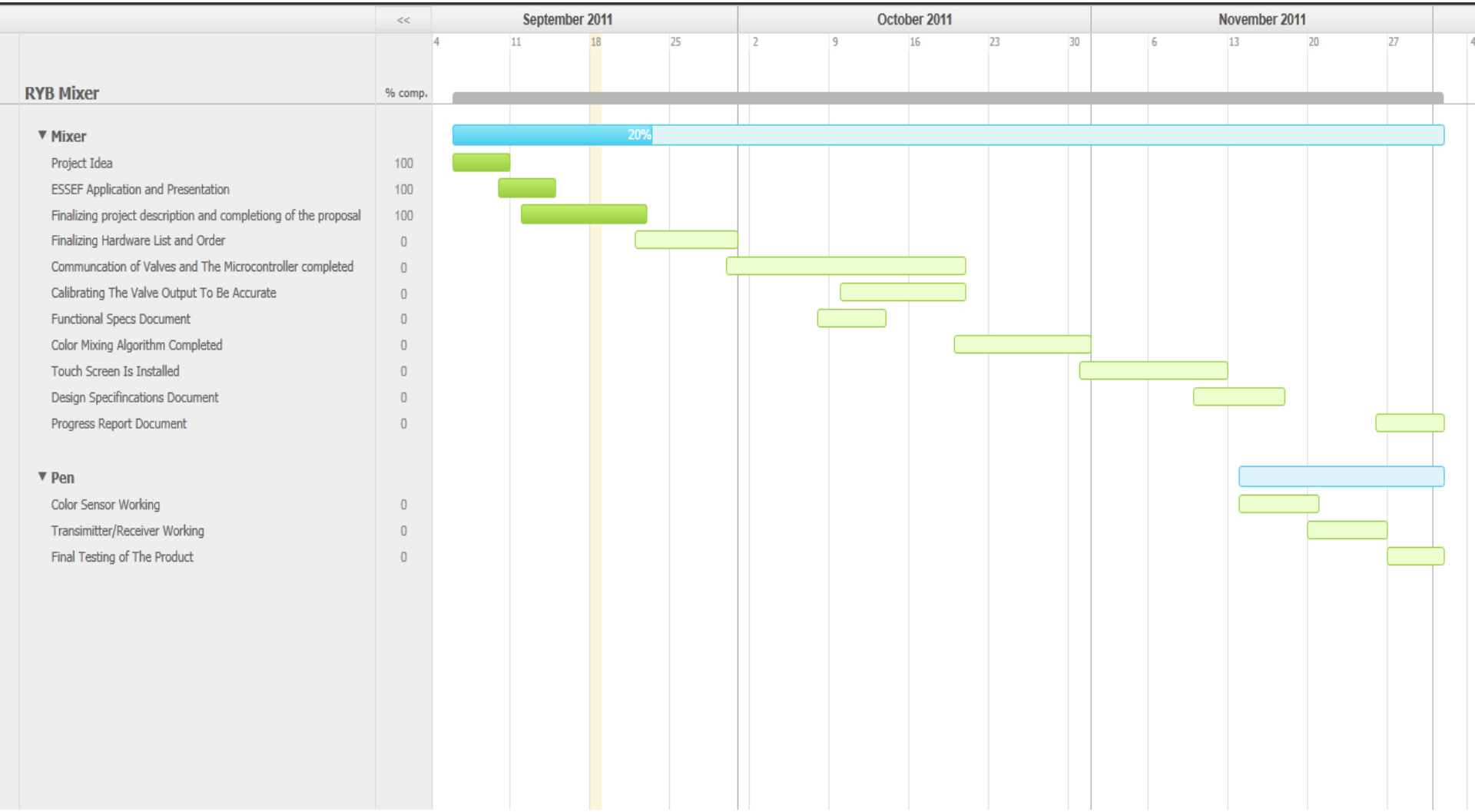
- Touch screen can break if the device falls.
- May have to use color thinner to clean the values.
- Color sensor may malfunction due to settled dust.
- Microprocessors can burn out.
- Batteries have to be replaced.
- Paint can dry inside the gravity cups if they are left open.

Difficulties

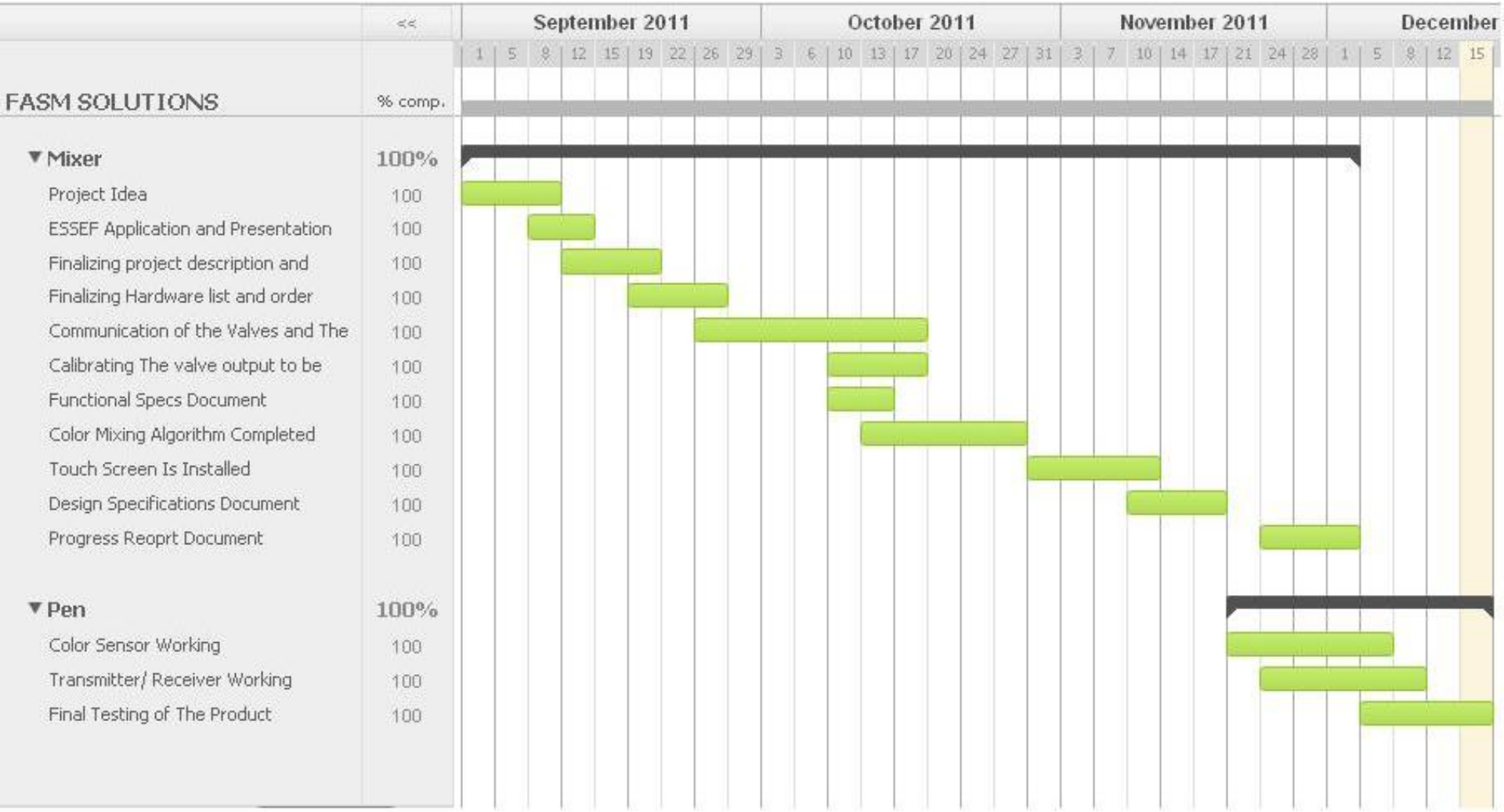
- Wireless communication
- Color code conversion.
- Solenoid valve timing and accuracy.
- System cleaning.
- Color matching.
- Color sensor error .

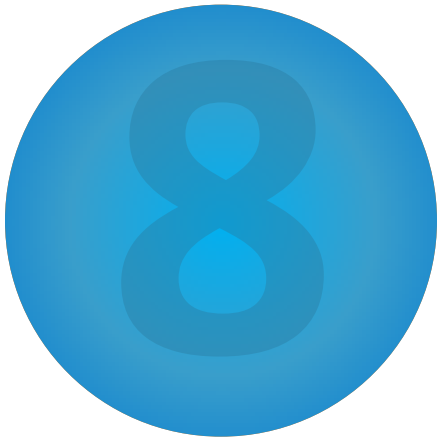
7 Timeline

Predicted Timeline



Actual Timeline

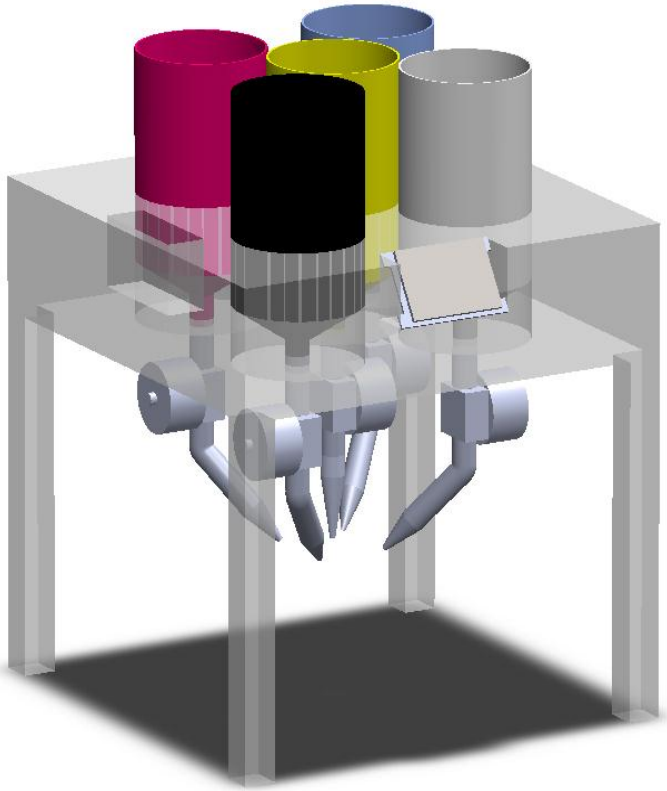




Future Development

Future Development

- Fiberglass body.
- Finished wireless pen.
- Improving accuracy of color mixing procedure.
- Case for the primary circuit.
- Product logo on the RGB paint mixer.
- More durable power supply.
- Better mixing container.



9 Conclusion

Learning Experiences

- **Professionalism**
  - Planning and scheduling
  - Time management
  - Team work
  - Communication
  - Improved research skills
  - Product integration and troubleshooting
- **Business**
  - Manufacturer contacts
  - Budgeting
  - Product selection and price matching

Conclusion

- Mixing unit can receive the RGB values sent by the wireless pen.
- Touch screen can receive the user input and send RGB values to the microprocessor.
- Microprocessor can open the valves and dispense the desired color.
- No leakage in the system.
- LCD displays the paint that is currently dispensing.
- Batteries can provide enough power to run the system
- System meets our safety requirements

10 Acknowledgments

We Would like to thank

- Dr. Andrew Rawicz
- Mr. Mike Sjoerdsma
- Mr. Fred Heap
- ESSEF (Funding)
- Mr. Kousha Talebian

Questions?

Thank You