COMPUTER & ELECTRICAL ENGINEERING

EGCP 471 PROJECTS COMPUTER ENGINEERING - II

FINAL FORMAL REPORT

VEGAS CHROMA SORT

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ABSTRACT

One objective is to have the ease of sorting and shuffling cards with a press of a button. Many individuals want the ease of sorting cards since it's time-consuming. Having this device would help sort many different cards according to their color or their type. The novelty of having your card sorted. Our project also drew inspiration from the principles of machine learning and computer vision, enabling it to recognize and categorize different colors accurately.Ultimately, the device should aim to save time, reduce manual effort, and enhance the overall experience of card sorting for individuals and businesses .

THEORY OR BACKGROUND

Our project seeks to design a device that will sort cards. The component used so far mainly consists of a robotic arm and its support frame. The most advancements came from the color sensor. Card sorting is the process of organizing and categorizing information or items displayed on cards. A card sorting device typically consists of a compartment, slot, or section where users can organize cards by criteria or category. The main purpose of card sorting devices is to help users sort, group, or arrange cards in an organized and easy-to-use way. Card sorting devices can be used for a variety of purposes, like organizing information, prioritizing tasks, or classifying content. Card sorting devices are versatile and can be used in a variety of contexts, from educational to professional projects management. Some card sorting devices have additional features, like labeling options, that make the sorting process clearer. Abstracted card sorting is a practical and physical way for people or groups to organize and organize information. It helps users to organize and organize diverse content in a more efficient and cohesive way.

Utilizing a combination of mechanical, electronic, and software engineering principles, the machine employs advanced sensors and sorting mechanisms to categorize and organize cards at high speed and with precision. The core of the system is powered by a sophisticated algorithm that can be tailored to different sorting needs, making the machine highly versatile and adaptable to various industries and applications.

DESIGN SPECIFICATION:

Our design manages to meet the following standards CpE SO(2), CpE SO(5), and CpE SO(7) by using modern robotics. For CpE SO(2), our project seeks to solve the time-consuming task of sorting cards. Since this will be automatic, this will also help those who are experiencing pain or disabilities with their hands, arms, or wrists. Naturally for this project, we work as a team so that we meet CpE SO(5). Coordination is applied for this project by separating responsibilities in the form of software and hardware. Since this project requires the use of outside software and hardware, CpE SO(7) is applied due to the need to learn unknown technology of the ESP32.

BLOCK DIAGRAM AND FUNCTIONAL EXPLANATION

Our arm starts at the Origin, the starting point, and then reads the card. The branching paths are red, blue, and neither. If it is a color, the arm picks up the card and then sorts it. Otherwise the card is flipped and then the card is read again.
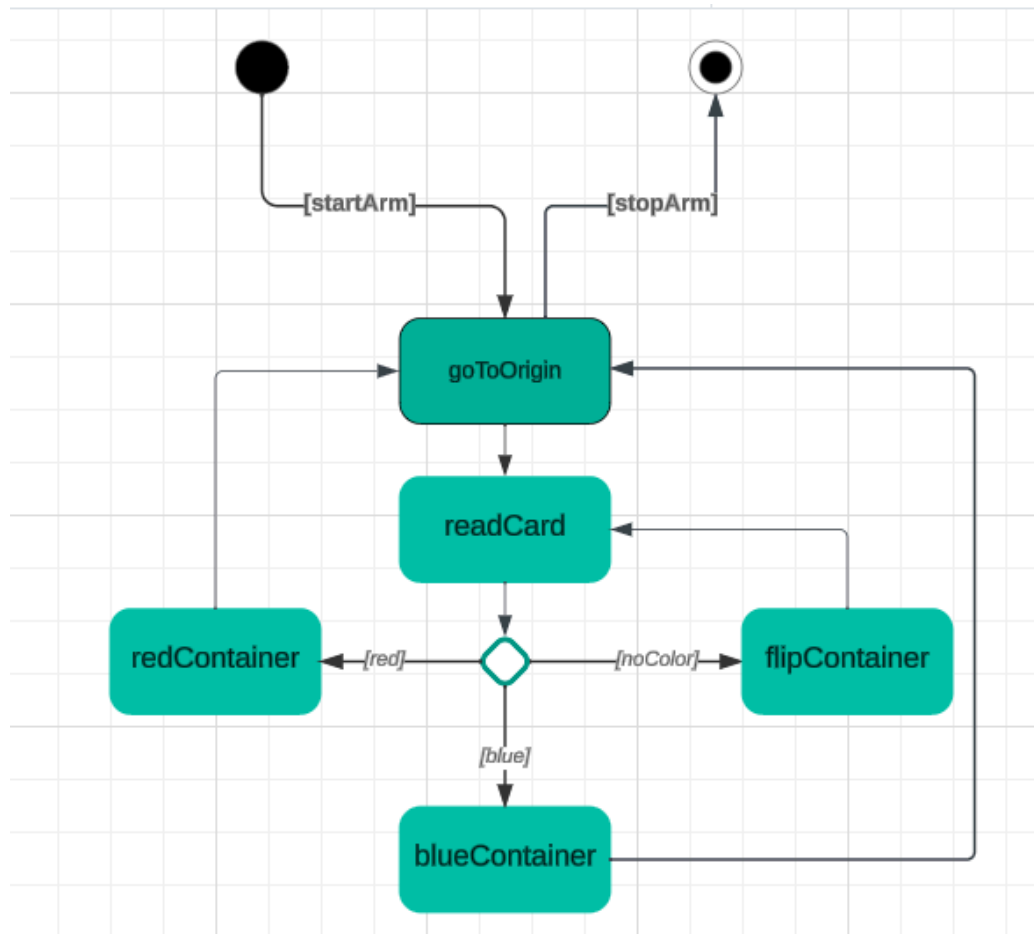
PARTS LIST

Product	Quantity	Cost Per unit	Cost w/o shipping tax
jumper wires	1	9.29	9.29
ESolder-able Breadboard for DIY Electronics Projects Compatible with DIY Arduino Soldering Projects 2.05"x3.5" (5 Pack + 2 Mini Board, Black)	1	12.59	12.59
TOOYFUL DIY Tank Accessories Track Conveyor Belt with TT Motor and Drive Wheels, Assembly Kits, Set	2	10.19	20.38
Arducam Mini Module Camera Shield 5MP Plus OV5642 Camera Module, Compatible with Arduino UNO Mega2560 Board	1	39.99	39.99
ECO-WORTHY Heavy Duty 330lbs Solar Tracker Linear Actuator Multi-function (12V, 12")	1	49.99	49.99
card holder	4	14.99	59.96
LCD screen	1	63.99	63.99
rotating robotic arm	1	69.99	69.99
Hiwonder WonderCam AI Vision Camera Robot Visual Module	2	65.99	131.98

Hiwonder MaxArm Open Source Robot Arm Powered by ESP32 Support Python and Arduino Programming Inverse Kinematics Learning	1	249.99	249.99
EPLZON HC-SR04 Ultrasonic Module Distance Sensor fit for Arduino UNO MEGA Nano Robot XBee ZigBee (Pack of 5 pcs)	1	12.99	12.99
Hiwonder 35KG High Torque HTS-35H Serial Bus Servo with Three Channels, Support Temperature, Voltage and Position Feedback	1	19.99	19,99
Bicycle Standard Rider Back Playing Cards, 2 Decks of Playing Cards, Red and Blue	1	4.49	4,49

Photos Through Design Process
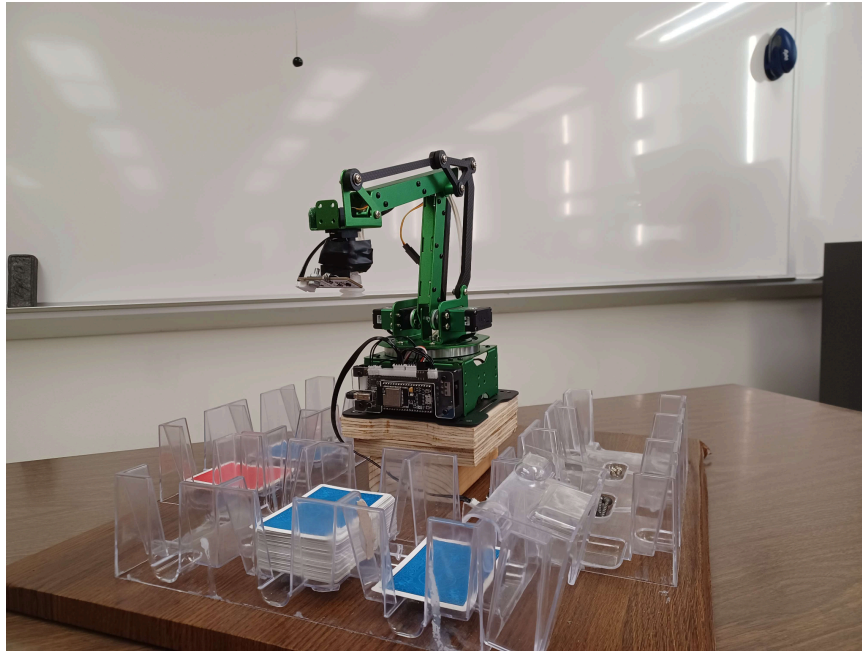
PERFORMANCE ANALYSIS

There are two main functions for the arm, sorting and flipping. The code for the arm is based on two main functions. The first one is, checking card color if the card is facing the right face then it takes it to the right slot either red or blue. The second function checks if the card is on the wrong side if it is, then the card is taken into the flipper so that it flips the card in-order to check the color then sort it, an ultrasonic sensor was used to display the color of the card detected which is a productive way to show the user if the prototype is working correctly. The arm takes about eight seconds to sort and place the card if it is either red or blue. If the arm determines if the card is flipped, then the arm takes about nineteen seconds to finish the process.

DISCUSSION OF RESULTS

After completing our Hardware and Software design we have put our prototype through lots of tests and our results show that this prototype is very effective.

We tested the color detection from the color sensor, it was very effective in getting the correct readings and colors from the device.

The second component that needed to be tested was placement of the cards at the correct slots which was also successful each and every time.

We have tested the flipping mechanism which we call the flipper, it showed that 90% of the times it was very successful it needed to be recalibrated a little bit more using the XYZ coordinates to get the issue handled but due to the time given it was not achieved on time .

PROBLEMS ENCOUNTERED

Starting with the first problem that occurred for this project is the fact that most of our documentations were in differentiating languages. For instance, the arm code notes and messages were not in English but instead in a foreign language so we had to use a translator to translate most of the documents to get a better understanding of what we were working with.

A different problem that arose is the missing hinge piece that would mount the camera and sensor to the arm itself. To overcome this, a custom part had to be designed because shipping was not an option due to the fact that it needed a lot of time to get shipped which we did not have.

We initially started our design using two control arms, one to pick-up the cards and one to flip the cards. The arm that was used to flip the card kept on burning motors randomly which was a reliability issue and also time consuming issue where we had to wait for motors to be shipped in and installed. So after taking a second look at the design we went from using a second arm to the flipping technique which would reduce complexity, space, cost of the design and increase reliability and still be accurate, we used gravity to our advantage where we had the arm drop a card on a flipper after it is flipped it would detect the color of the card.

After configuring our arms and how we were going to sort them, we started by designing our identification which is the part that identifies the card's color. We first used an AI camera that would identify the cards. We realized that the camera would take too much space in the slots assigned to each card which would affect the movement of the arm, this would also increase complexity, storage and cost on the buyer for something that could be done in an easier approach which is by using a color sensor that would detect colors instead of having preset values for each card in the memory.

INDIVIDUAL TASK ASSIGNMENTS

- Moniel Flores (Lead Coder)
  - Managed to implement and verify arduino code

- Hashem Algharabally (Assistant coder)
  - Formatted the code
  - Help with the main Code

- Zaid Frayeh (Main Designer/Hardware manager)
  - Chassis assembly.
  - Building the Flipping mechanism instead of using a second arm, which minimizes the tasks to be done by the software team.
  - The Design was designed in a way to have the control arm reach all of the areas on the chassis since our control arm can only have an angle of rotation of 180.
  - Code implementation on the arm.

- Danah Mohammad(Assistant Designer)
  - Helped with putting the arms together
  - Building the robots

CONCLUSION

The development of the "Vegas Chroma Sort" device has been a successful endeavor in branching software and hardware. The device has met its initial goals. The "Vegas Chroma Sort" project has successfully developed a device that can sort colors without hands-on intervention. The reliability of the Vegas Chroma Sort works, given the time constraint, while operating the arm works without breaking down. The current cost of the Arm is something to be desired, given that the arm can produce results without intervention, the labor supersedes the cost.

FUTURE WORK

Some of the future work include:

- expanding card type recognition, which is very much helpful for all types of users especially card enthusiasts.
- Designing a user interface, which would help users achieve his desires with a friendly user interface.
- Increasing speed of the prototype to make it even faster.
- integration with external systems and making our design one of the IoT systems.
- Handling larger numbers of cards.
- integration of AI with a camera that would identify various cards on the spot without the need of pre-programming the cards in the memory.
- Adding shuffling feature

REFERENCES

"Hiwonder." *Www.hiwonder.com.cn*, www.hiwonder.com.cn/store/learn/110.html.

Accessed 23 May 2023.