Robotic Arms : Histiocial Evolution, Contemporary Application and Cost-Effective Construction on a limited budget

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Introduction:

While conducting research on topics and projects we could conduct we decided to look more personally and into our environment. Tesla is a Car manufacturing company priding itself in its innovative technology and state of the art manufacturing process so we decided to analyze this aspect of their company and see if we can get a project out of it. Thanks to this research we discovered the vastness of applied robotics such as robotic arms. We concurred on the following problem being the most effective way to look into robotics and engineering given the limited resources we had; We seek to find the historical and modern components that make up the robotic arm that can benefit society and figure a way to build a cost effective robotic arm.

Mixed with its complex history that is parallel to robotics as a greater topic robotic arms are programmable mechanical devices that mimics the movement and function of a human arm, with servos controlling its precise movements. These servos, or small motors, power the arm's joints and allow it to perform tasks like lifting, rotating, and manipulating objects. Originally created for manufacturing purposes they can currently be seen in industries like aerospace, healthcare, and automation. Robotic arms rely on the relationships between the software and hardware components to improve accuracy and efficiency. As technology evolves, the many components like servos help make robotic arms more versatile, enabling them to perform both simple and complex operations. We will be taking part to work hands on a robotic arm that mixes the limited budget and learning opportunity gained by the model of robotic arm.

Purpose:

We plan to conduct an introspective reflection on the history and application of robotic arms while building our own cost-effective model with a budget of 100 dollars. We plan to then conclude with our analysis and predictions on the future of robotic arms and the greater robotic field.

Problem:

What history has contributed to the creation of the robotic arm?
How would someone build a cost effective robot ?
How could robotics and robotic arms be used to benefit society?

Hypothesis :

Although we plan to do the reflection on robotic arms and a prediction of its future we also want to see if a robotic arm could be created in a cost effective method and could be used for the benefit of the creator and greater society.

Materials:

An Arduino electronics set or individual purchase of the following

- Push buttons (6 for this version)

- Wires (33 for this version)
- Breadboard
- Arduino board
- USB cable

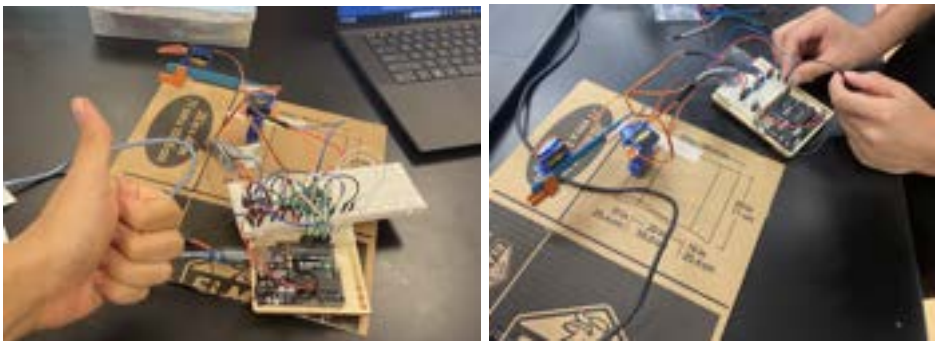
Software:

1. A Windows or Mac computer compatible with Arduino IDE and has functional USB ports
2. Arduino IDE

Hardware:

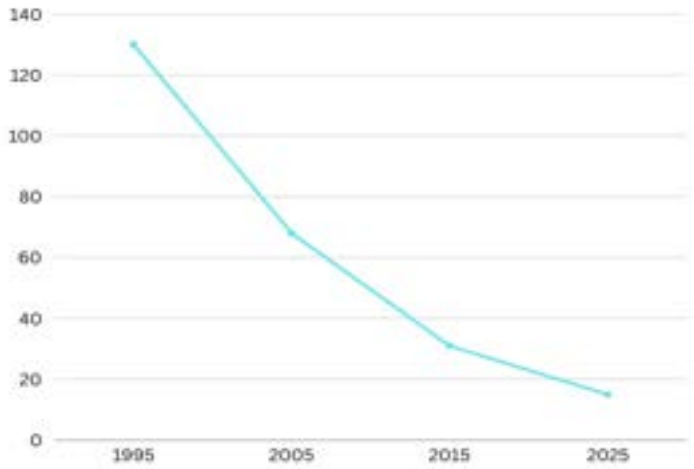
1. Cardboard
2. Popsicle stick
3. Double-sided foam tape or tape
4. Hot glue
5. Zip ties or twist ties

Pictures



The pictures show our project and how it looks like while building

Figure/Table:



This graph represents an estimation of how the price of industrial robotics seemingly managed to drop over the years however prices vary and we took the estimation based on the most cost effective models.

Procedure:

We followed an online procedure and model; however, we made our own changes and tweaks to save on time and money:

Step 1. Create a design and sketch it
Step 2. Acquire all materials and software
Step 3. Connect the Arduino to the breadboard
Step 4. connect the servos to the breadboard ensuring that all connections are secure
Step 5. Build the code
Step 6. Test code
Step 7. Construct the Arm with the servos
Step 8. Final test of the code, connections and servos
Step 9.You have completed the Robotic arm projected based on the Science Buddies science project

Analysis:

Industrial robotic arms can range from as low as $25,000 up to $400,000 per arm (“Robot machine price”, 2024). The wide range of prices comprises the different variables that make each robotic arm model, from the number of axes, weight limit, and functionality. While personal robotic arms can range as low as $50 or up to $1,500 the technology in this type of robotics has the widest range of advancements from hi-tech to DIY robotic arms. With lower-end and cost-effective robotic arms, like the one we built, having drawbacks with limited motion, weight, and functionality, the obvious connection between price and functionality that is prevalent in all technology shows itself the most. The robotic arm we constructed managed to function as we programmed and planned, being able to lift objects that are relatively lightweight and small. We built the robot while exploring the different possibilities for robotic arms, the history, functionality, and the greater scope of robotics in our lives, and concluded that robotics will be a large part of our future so finding ways to cut on cost and make cost-effective electronics would not only benefit people like us who come from low income and disadvantaged communities but also for the greater public. We also discovered that robotics are generally seeing a drop in price with estimates lowering them as low as $10,000.

Conclusion:

Robotic arms have a deep and complex history that is intertwined with computer and technological advancements that we further dive into in our research paper but key contributions to robotic arms are: the first robotic arm (1959), the first six-axis robot (1969), and the first use of AI in robotic (1972) (Thompson, 2021). While the history of robotic arms is a deep and complex concept one common variable is the otherworldly cost and expenses for industrial robotics. With many high-end robotic arms like the Da Vinci surgical robot costing up to $2.5 Million, robotics and the robotic field will always hit a wall for people who cannot meet the exorbitant cost of the technology. However, all walls can be jumped and the technology is not completely closed for the less fortunate as DIY and relatively cost-effective robotic arms can be found. We specially made a DIY robot that loosely followed the blueprint laid down by ScinceBuddies although the purpose of the Robot was to examine the time and cost of the robotic arm, one could easily tweak software or hardware to make the robot more complex. Our robot build did not exactly

follow the links and materials provided by ScienceBuddies as we found an alternate for the Arduino board they gave that saved around $20-30 and an inexpensive set of servos. Together we managed to stay on the lower end of the estimated price around $50-60. Due to previous experience, we had the robotic arm up and ready within a day with slight issues with the breadboard being resolved the next day. However for someone inexperienced with Arduino and robotics in general a good estimate for this robotic arm would be around a week with a short time spent per day. We conclude our hypothesis to be successful and true, but it has some limitations. Like the previously mentioned historical connection with robotic arms, the future of robotics and robotic arms is complex and a deeper dive would be found in the research paper. However, we can conclude that robotic arms and robotics are here to stay and will be the future of many industries. They can easily replace easy and simple tasks that a human could do with ease and with more advanced robotics from Figure and Tesla combining robotics with deep-learning Artificial intelligence.

Applications & Further Research:

The affordability of robotic arms opens up opportunities to transform daily life and economic potential through increased automation. It automates tasks such as the carrying of loads repeatedly in an industry, cutting labor costs and increasing efficiency, which reflects directly in the consumers' reduced costs. This, therefore, improves convenience and saves time for people within their houses from duties like cleaning and cooking. Additionally, because of their affordability, small businesses and startups are in a position to adopt automation, hence competing with big corporations and growing the economy.

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