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Artificial Reaching and Feeding Hand

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ABSTRACT

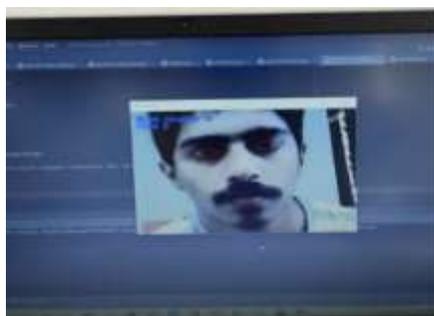
Robotic arms are designed for helping disabled people. The main function of the robotic arm is feeding food and drinks for disabled people. Nowadays there are so many robotic arms available in our market. These arms are more expensive because they use high-level technologies like sensing brain signals of arms and perform the task according to this. These expensive products are not affordable by common people. We are introducing this light weight portable robotic arm for feeding disabled people in affordable price. The ultimate aim of this proposed methodology is to assist the persons with movement disorder who need the help of someone to feed themselves. The proposed methodology comprises of four servo motors, one Arduino controller and one USB camera. By detecting the eye blinking of the user, the operation will be initiated. The required height will be obtained by detecting the lip area of the user with the help of USB camera fixed on the robotic arm. Arduino uno is programmed in such a way to co-ordinate the required movements of the arm. The desirable robotic arm position is accomplished by the rotation of servo motors. The assistive feeding device has a gripper which can hold a spoon or a cup according to the written program. The motors will rotate in both directions to take the meals and drinks and feed to the user.

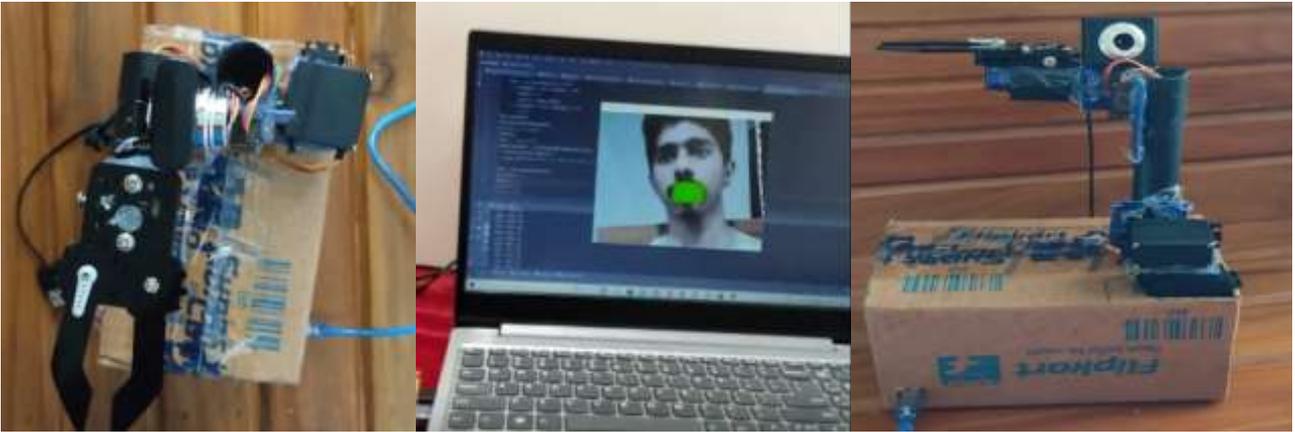
Keyword- Disabled People, Robotic Arm, Arduino Uno, Computer Vision

1. INTRODUCTION

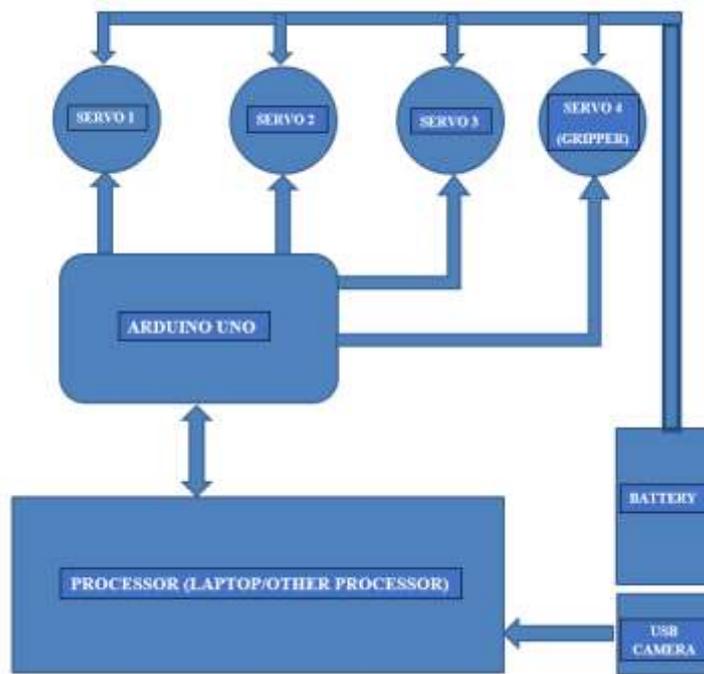
India is a country with large number of disabilities, according to recent survey nearly 2.21% of India's total population has severe disabilities which nearly 2.68 crore in number. Among those nearly 85 lakhs of people are affected by the disability in movements in which nearly 70% of people belongs to rural area and other 30% belongs to urban. People in rural are mostly illiterate and cannot afford for a caretaker. In such cases feeding the people with disability in movement of hand is a great challenge. The proposed methodology focuses on feeding of meals and drinking water to the person with disability using a robotic arm. The existing methods have some cons like to appoint a care taker to operate the device and in countries like United States, United Kingdom an automata robot is there but it is too costly. The proposed work mainly focuses on feeding meals and drinking water to the person with disability without the help of caretakers and at affordable price. Existing techniques are quite costly which cannot be afford by the rural people of India and other few existing methods are quite based on technologies which cannot be understand by the people of rural India. Technologies that are used in this method are quite easy and understandable and cost is quite low compared to other devices available in the market.

2. METHODOLOGY





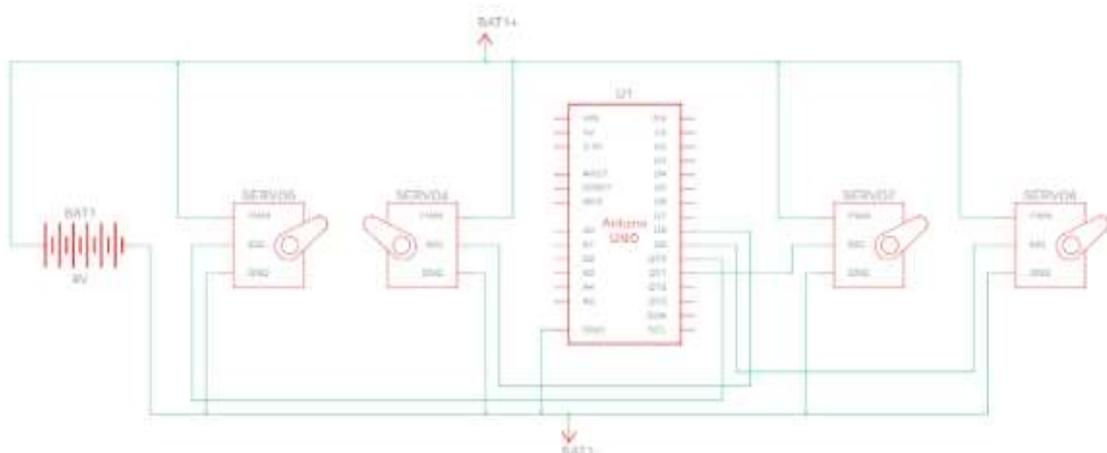
3. BLOCK DIAGRAM



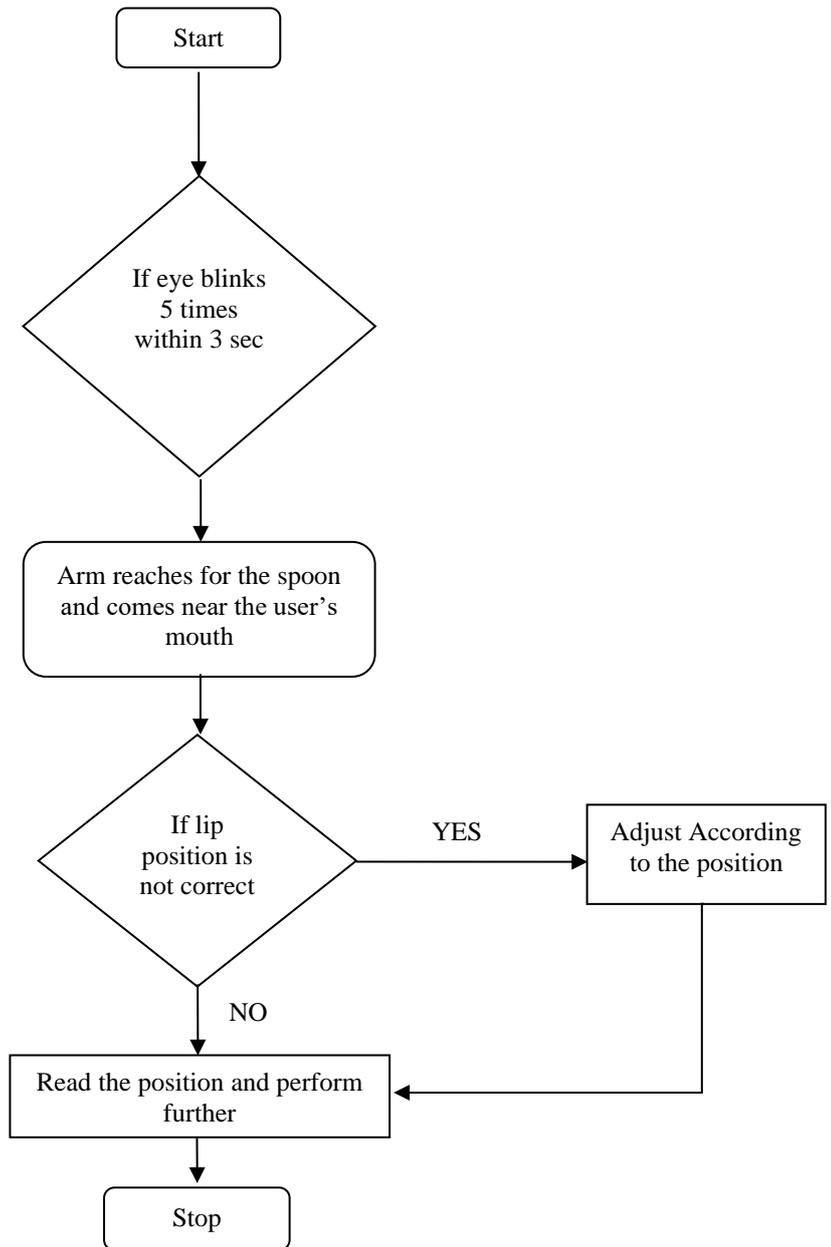
4. OPERATION

When the user blinks 5 times within 3 seconds the camera fixed on the robotic arm will detect it with the help of computer vision and starts the circuit. The arm then moves towards the glass of water placed in front of it and picks it up using the gripper. The arm comes back up while the usb camera detects and signal the position of the person's mouth. The arm then moves towards the mouth and stops. The user can blink 5 times again and the arm will place the glass back where it picked it up and goes back to its original resting position. The arm motion is provided by servo motors which is controlled by a microcontroller.

5. CIRCUIT DIAGRAM



6. FLOWCHART



7. COMPONENTS USED

A. *Arduino Uno*

The Arduino Uno is a microcontroller board based on the ATmega328 (datasheet). It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz ceramic resonator, a USB connection, a power jack, an ICSP header, and a reset button. It contains everything needed to support the microcontroller; simply connect it to a computer with a USB cable or power it with a AC-to-DC adapter or battery to get started. The Uno differs from all preceding boards in that it does not use the FTDI USB-to-serial driver chip. Instead, it features the Atmega16U2 (Atmega8U2 up to version R2) programmed as a USB-to-serial converter. The Uno is a microcontroller board based on the ATmega328P. It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz quartz crystal, a USB connection, a power jack, an ICSP header and a reset button. It contains everything needed to support the microcontroller; simply connect it to a computer with a USB cable or power it with a AC-to-DC adapter or battery to get started. "Uno" means one in Italian and was chosen to mark the release of Arduino Software (IDE) 1.0. The Uno board and version 1.0 of Arduino Software (IDE) were the reference versions of Arduino, now evolved to newer releases. The Uno board is the first in a series of USB Arduino boards.

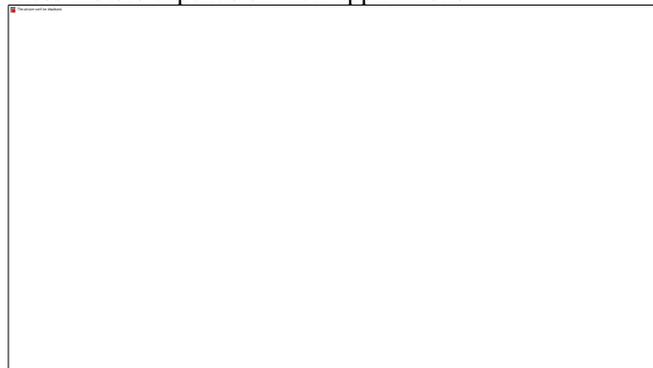
Microcontroller	ATmega328P
Operating Voltage	5V
Input Voltage(recommended)	7-12V
Digital I/O Pins	14
PWM Digital I/O Pins	6
Analog Input Pins	6
DC Current per I/O Pin	20 Ma

DC Current for 3.3 V Pin	50 Ma
Flash Memory	32 KB (TMega328P) of which 0.5 KB used by boot loader
SRAM	2 KB(ATmega328P)
EEPROM	1KB(ATmega328P)
Clock Speed	16 MHz



B. Servo Motor

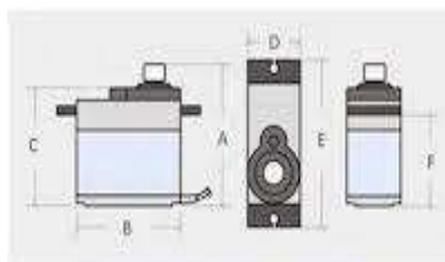
A servo motor is a rotary actuator or a motor that allows for a precise control in terms of the angular position, acceleration, and velocity. Basically, it has certain capabilities that a regular motor does not have. Consequently, it makes use of a regular motor and pairs it with a sensor for position feedback. Servo motors can be of different types on the basis of their applications. The most important amongst them are: AC servo motor, DC servo motor, brushless DC servo motor, positional rotation servo motor, continuous rotation servo motor, and linear servo motor. A typical servo motor comprises of three wires namely- power, control, and ground. The shape and size of these motors depends on their applications.



1) *MG-995*



The 10kg.cm Metal Gear Servo Motor - MG995 can rotate approximately 120 degrees (60 in each direction). You can use any servo code, hardware or library to control these servos, so it's great for beginners who want to make stuff move without building a motor controller with feedback & gear box, especially since it will fit in small places. The MG995 Metal Gear Servo also comes with a selection of arms and hardware to get you set up nice and fast!



PRODUCT CONFIGURE TABLE

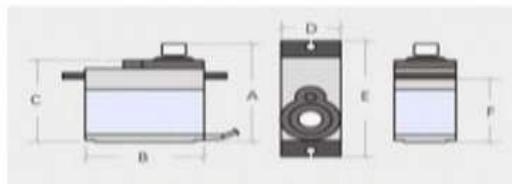
Weight(g)	55
Torque(kg)(4.8v)	8.5
Speed(sec/60deg)	0.2
A(mm)	42.7
B(mm)	40.9
C(mm)	37
D(mm)	20
E(mm)	54
F(mm)	26.8

2) MG-90S



MG90S Metal Gear Mini Servo is tiny and lightweight with high output power, this tiny servo is perfect for RC Airplane, Helicopter, Quadcopter or Robot. This servo has metal gear for added strength and durability. Servo can rotate approximately 180 degree (90 in each direction), and works just like the standard kinds but smaller.

Product Description



PRODUCT CONFIGURE TABLE

Weight(g)	13.4
Torque(kg)(4.8v)	1.8
Speed(sec/60deg)	0.1
A(mm)	32.5
B(mm)	22.8
C(mm)	28.4
D(mm)	12.4
E(mm)	32.1
F(mm)	18.5

C. 1/4 CMOS 640*480 USB CAMERA



It is very compact in size and easy-to-carry one. It supports 300k pixels and has a USB 2.0 port for convenient use, is really a plug-and-play device and gives maximum resolution upto 640 x 480. With a retractable USB cable, it provides great convenience for use.

1) Specifications:

Resolution:	640X480
max pixels:	12m pixels
Interface:	USB 2.0
Sensor:	1/4 Cmos
Operating Current:	<120 mA
Picture Format:	VG

D. GRIPPER (ACRYLIC)

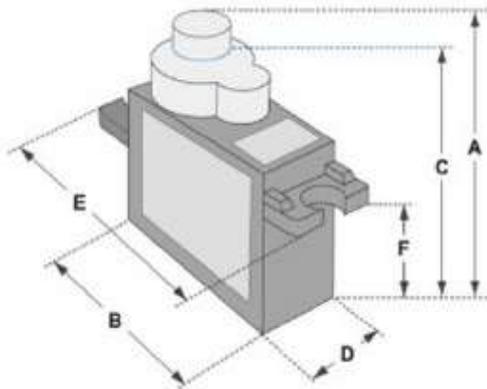


This is an excellent robotic gripper for development of any robotic arm project without spending a lot of money. This beautiful robotic arm gripper is best suitable for pick and place type robots and it can also be used for other robotic and IoT projects. It is a perfect hold and release gripper. This is a pre-assembled high quality multi-purpose laser cut acrylic robotic gripper. It uses a low RPM BO Motor that can be controlled using DPDT switch for manual control and microcontroller or IoT b.

1) SG-90



The gripper is built with SG-90 Servo motor. The TowerPro SG90 9g Mini Servo is a 180° rotation servo. It is a Digital Servo Motor that receives and processes PWM signal faster and better. It equips sophisticated internal circuitry that provides good torque, holding power, and faster updates in response to external forces



Dimensions & Specifications	
A (mm) :	32
B (mm) :	23
C (mm) :	28.5
D (mm) :	12
E (mm) :	32
F (mm) :	19.5
Speed (sec) :	0.1
Torque (kg-cm) :	2.5
Weight (g) :	14.7
Voltage :	4.8 - 6

E. BATTERY



The nine-volt battery is a common size battery that was introduced for the early transistor radios. A standard 9V has about 400-600 mAh capacity. In the most basic terms, these batteries can supply about 500 milli-amperes for one hour.

8. APPLICATION

A. FEEDING ARM

Disabled people cannot do tasks by themselves. Instead of relying on another person for their basic need such as drinking and eating. Feeding hand is used to feed food and drinks to disabled people with the help of gripper. The feeding arm can be used for other applications as well, this is possible by changing the type of arm gripper. Other applications are as follows.

B. WELDING

Arc welding, oxyacetylene welding, submerged arc welding, flux-cored welding, plasma cutting, TIG welding, laser welding, plasma welding, resistance welding, MAG welding, orbital welding, MIG welding, shielded metal arc welding, spot welding.

C. MATERIAL HANDLING

Pick and place, press tending, packaging, injection molding, machine loading, machine tending, part transfer, palletizing.

D. OTHER APPLICATIONS

3D laser vision, drilling, painting, polishing, fiberglass cutting, appliance automation, refueling, sealing, sanding, routing, grinding, material removal, coating, cutting, meat processing, cleaning, thermal spraying, milling, waterjet, deburring. These are also used in medical surgery. Such an extensive use of the robotic arms ensures multiple benefits. These significantly reduce human labor. Also, greater precision and repeatability can be availed with the robotic arms. Thus, these offer higher productivity. Further, a robotic arm prevents injuries to the employees. That's why they find a great application in dangerous works like a nuclear experiment, bomb diffusing, sewer cleaning and so on. Researchers are trying to design and develop more dynamic robotic arms so as to expand their applicability and perform a wider range of tasks.

1) *Drawing & Writing*

With the pen holder module, robot can write a beautiful hand-writing letter and draw an artistic picture, bring arts to your home or write your homework.

2) *Laser Engraving*

Robot can be easily transformed into a laser engraver with the laser engraving module. It is capable of engraving on wood, leather, paper, and other materials. You can make a meaningful gift for your friends within a few minutes.

3) *Pick & Placing*

Picking and placing objects can be easily performed with the help of a suction cup and soft gripper. Perfect for lightweight industrial applications.

9. ADVANTAGES

There are lots of robotic arm available in market with more functions and accuracy but considering cost as a main problem our arm will hit the peak. Advantages of using our robotic arm instead of other existing model of robotic arm available in market are as follows.

1. Working principle is quite easy.
2. Less maintenance cost.
3. It is easy to construct.
4. This system is flexible.
5. Low power consumption.
6. System is easily portable.
7. Low production cost.

10. CONCLUSION

Thus, a physically challenged person can drink water or eat food that is kept ready in front of them anytime they want without another person's help. In a middle-class working family, the time to spend apart from their jobs to take care of a disabled person is not practical and appointing a caretaker is financially unbearable. So, in such cases it is recommended that by using this "ARTIFICIAL REACHING AND FEEDING HAND" not only the worry of not being there to feed a disabled person is resolved but also makes the person capable of achieving a basic need of drinking water or eating food placed in front of them by themselves whenever they're in need of it. And also, this is a portable device which can be strapped onto the handrail of the person's chair hence it can be used for another person on another chair by fastening it onto their chair.

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