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# *Robotic Classifier*

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***Abstract***

*Robotics is one of the most interesting and fastest growing industry in recent times. The reason being the fact that it makes use of most of the branches of engineering namely – Mechanical Engineering, Electrical Engineering and Computer Science. Today, Robotics is one of the most rapidly growing field, as technological advancements continue; researching, designing and building new robots serves various practical purposes, whether commercial, domestic or military.*

*Robotic Classifier is an automated robot that can classify an object based on its structural property. It can sense the hardness and softness of the object with the help of various sensors and can classify them.*

*The basic reason of choosing ROBOTICS as a project is that we want to make a robot that can work automatically and classify the objects as hard or soft on the basis of their structural properties and collect the specified type of object.*

***Keywords:*** *Arduino UNO, Object Classification, Object Detection, Pick and Place, Robotic Classifier.*

## INTRODUCTION

The goal of this project is to develop a robot that will classify an object on the basis of its structural properties. The robot will sense an object whether it is hard or soft and collect the specified type of object. This will help us to differentiate solid waste from all other waste in an industry thus preventing any accident. This robot will also help in automobile industries to remove the type of problems that may cause unexpected failures. The brain of the robot is a micro-controller that control all the components which are embedded into it using an IDE platform. Through IDE a robot can be programmed to perform a specific task. It will detect an object, distinguish the object and pick a specific type.

## II. LITERATURE SURVEY

We have referred few research papers at the time when we were working on our idea to gain knowledge about our project. Some related research papers are as follows:

Dheepak Mohanraj [1] presented his work on how to build an autonomous robot which is a Pick and Place Robot using Line Tracking. Homberg et.al [2] developed their work on a soft hand capable of robustly grasping and identifying objects based on internal state measurements, which is a highly compliant hand allows for intrinsic robustness to grasping uncertainty.

Pankaj Agarwal et.al [3] prepared a research paper on automated material handling system which aims to create autonomous robot that can identify objects when placed on the conveyor belt based on color sensing and then sort by relocating them to a specific location.

Alexander Schneider et.al [4] gave a novel approach for identifying objects using touch sensors installed in the finger tips of a manipulation robot. Our approach operates on low-resolution intensity images that are obtained when the robot grasps an object.

Dharmannagari Vinay Kumar Reddy [5] created a work on how autonomous robots can provide effective solutions to gruelling task, In this case, it is desirable to create an autonomous robot that can identify objects from the conveyor belt and relocate them if the object meets certain criteria. Vishnu R. Kale et.al [6] presented a smart approach for a real time inspection and selection of objects in continuous flow.

Katzschmann et.al. [7] demonstrates autonomous soft grasping of objects in the plane.

Nisha et. al [8] prepared the design of a Vision assisted pick and place robotic Arm. The main objective of the paper is to pick and place an object from one place to other by 2 DOF robotic arm.

Ashutosh Saxena et. al [9] created robotic grasping of novel objects using vision.

Rahul Kumar et. al [10] expressed their work on Controlling a Robotic arm for applications such as object sorting with the use of vision sensors would need a robust image processing algorithm to recognize and detect the target object.

N.I. Giannocarro et. al [11] demonstrated a mechatronics application to automatically sort objects with a robotic arm. The robotic arm picks similar objects and moves them in order to read the information contained in tags.

## III. PROBLEM STATEMENT

Robotics is advancing rapidly in all areas. Presently various Industries is moving from manual to automation to increase productivity and also to deliver uniform quality.

On the other hand, Solid wastes generate hazards to the global environment. The waste sorting is the determining step in which materials with the same recycling characteristics are divided; many interesting proposal have been recently proposed using different strategies and different sensors for automating the waste sorting. Thus, Robotic Classifier is an automated robot that is tackling the problem of solid wastes in industries using application of robotics.

Our focus is to develop an automated robot which will help in gathering the objects from the surface that are solid waste, thus preventing such type of waste from causing harm to environment. This robot will also help in automobile industries to remove those type of problems which may arise unexpected events.

After keeping these problems in mind, we decided to develop an automated robot which senses the objects on the surface and differentiates them and keep them at a particular defined place.

## IV. METHODOLOGY

### *I. Micro-Controller (ARDUINO UNO)*

It is computer hardware, open source and micro-controller based kits for developing digital devices. Arduino 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. You can tinker with your UNO without worrying too much about doing something wrong, worst case scenario you can replace the chip for a few dollars and start over again.

The Uno board is the first in a series of USB Arduino boards, and the reference model for the Arduino platform; for an extensive list of current, past or outdated boards see the Arduino index of boards.

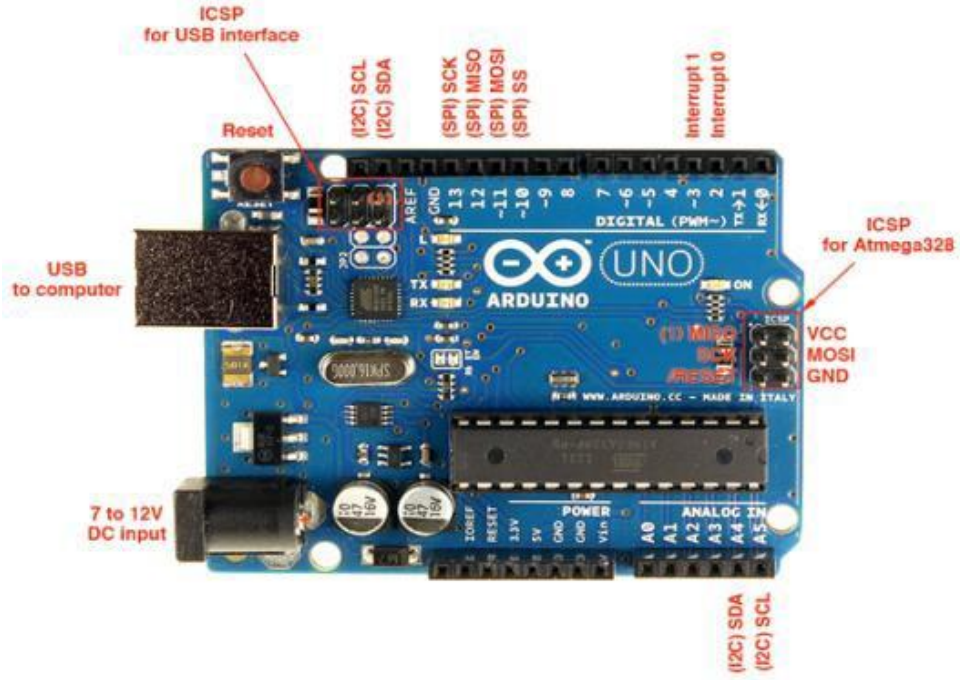


***Figure 1: ARDUINO UNO***

### *II. ARDUINO IDE*

Arduino IDE is a cross platform application written in Java, and derives from the IDE for the processing programming language and the Wiring projects. It includes a code editor with features such as syntax highlighting, brace matching, and automatic indentation, and is also capable of compiling and uploading programs to the board with a single click.

A program or code written for Arduino is called a sketch. Arduino programs are written in C or C++. The Arduino IDE comes with a software library called "Wiring" from the original Wiring project, which makes many common input/output operations much easier.

### *III.* ROBOTIC ARM

A robotic arm is a type of mechanical arm, usually programmable, with functions similar to a human arm. It is used to pick an object and place it at a desired location.

The end effector, or robotic hand, can be designed to perform any desired task such as gripping, spinning, etc. depending on the application. When an object is detected by the robot, the object can be grabbed by using the robotic arm.

***Figure 2: Robotic Arm***

## *IV.* OTHER COMPONENTS:


***Figure 3: Motor Driving Shield And Uv Sensor***

DC Motors, Sensors like UV Sensor, IR Sensor etc., Motor Driving Shield, external power source, wheels.

## *V.* ALGORITHM:

***Object Detection:***

I. Method is used to calculate distance: get Distance() by using formula:

distance = pulse Time*0.034/2

Where pulse Time =pulse In(echoPin, HIGH)

It will return a value of distance of object from sensors.

***Pick and Place:***

I. If distance<100 cm then robot will stop and it perform some methods to pick

and place an object by using methods like arm up(),arm down(),arm forward() etc.

II. These above methods are used for movements of robotic arm.

***Classification:***

I. When sensor detect an object then the robotic arm reaches for the object and grabs it After this, classification will take place by using classification sensor.

II. This sensor is used to distinguish whether an object is hard or soft.

III. If it is hard or soft, it will collect it as defined in source code

## V. PROPOSED WORK

I. Robotic Classifier is an automated robot that can classify an object based on its structural properties. It can sense the hardness and softness of the object with the help of various sensors and collect a specific type of objects.

II. The whole project is divided into 3 modules: Object Detection, Object Classification and Pick and Place.

III. First of all, we will create an automated robot that can detect an object in its path, after which further modules i.e. Pick and Place, Object Classification will be added to the robot.

IV. While making Robotic Classifier, all wheels are connected to the DC motors which are then fixed below Chassis.

V. Wires are soldered with the motor and connected to the Motor Driving Shield. Driving Motor Shield is mounted over Arduino UNO and this whole setup is fixed over the chassis.

VI. An Ultrasonic Sensor is fixed at front of the robot and it has 4 pins named VCC, Gnd, Trig & Echo which via F-M & F-F wires are connected to the Motor Driving Shield.

VII. A robotic arm with classifying sensor is mounted over the robot to pick up the objects and place them. Motors are used in the arm to control the movement of arm. Robotic arm is connected to the microcontroller. Microcontroller controls the movement of the arm as programmed using IDE.

VIII. Program is booted in the microcontroller using USB port via USB cable and using IDE. External sources like adapter and batteries are used to supply power to the robot for its movement and movement of the arm.

IX. When all the components are assembled and external power is supplied to the robot, *robot will start from its initial position, the arm will first go to its initial state then the robot will start moving forward, when an object comes in its path then the UV sensor will detect it at a certain distance. This range is defined in the source code.

X. When the object is detected, the UV sensor send a signal to the microcontroller so that the robot could be stopped for further process. Now the object will be checked for hardness and softness in the object classification module using robotic arm.

XI. The arm will reach to the object, grab it with its jaw. Now it will classify the object using sensor fixed in the jaw. The jaw will apply pressure on the object, if the object is soft it will be pressed otherwise if hard it will retain its shape. Based on it object will be distinguished.

XII. If the object is as specified in the code (e.g. hard),the microcontroller will instruct the robotic arm to pick the object and collect it.

## VI. RESULT

When power supplied to robot, it will start moving, and when object is detected, the arm will work as shown in the images given below:

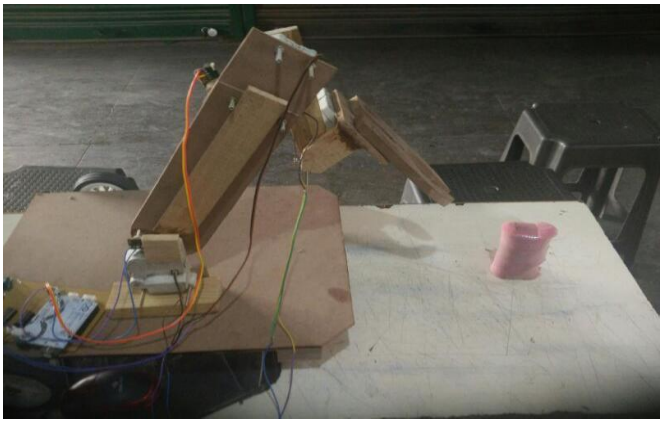

***Figure 4: Arm moves towards object***

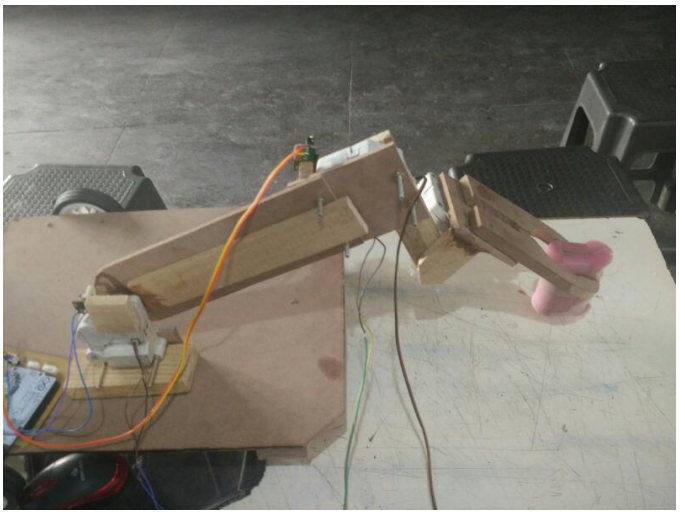

***Figure 5: Arm grabs an object***

***Figure 6: Arm places an object***

**TYPE OF OBJECTS:**

***Figure 7: Soft object***

***Figure 8: Hard Object***

***Table 1: Experimental Table***

| Iteration | Type of object | Action Required | Action Performed | Accuracy Rate (%) |
|---|---|---|---|---|
| 1 | Hard | Swipe | Yes | 100 |
| 2 | Soft | Pick | Yes | 100 |
| 3 | Hard | Swipe | Yes | 90 |
| 4 | Hard | Swipe | Yes | 100 |
| 5 | Soft | Pick | No | 20 |
| 6 | Hard | Swipe | Yes | 100 |
| 7 | Soft | Pick | No | 0 |
| 8 | Soft | Pick | Yes | 100 |
| 9 | Hard | Swipe | Yes | 100 |
| 10 | Soft | Pick | Yes | 70 |

Above table shows the experiments conducted on Robotic Classifier, showing the success and failure rate of Robotic classifier when it will try to pick or swipe an object using robotic arm.

***Error Rate:***

Error rate is the ratio of total number of errors and total number of outcomes.

**CONCLUSION**

Robotic classifier is a robot that can detect object and identify that whether it is hard or soft and pick a specific type of object (hard or soft) as specified in the program. It will help in gathering the objects from tra as well as from su that are recyclable and the solid waste, thus preventing such type of waste from causing harm to environment. This robot will also help in automobile industries

to remove those type of problems which may arise unexpected events.

## FUTURE WORK

The accuracy of the components used in this robot can be improved so that the robot can work more accurately. Also the robot, after some advancement, will be able to work on real world applications in the industry. Image processing can be used to detect objects using camera sensors so it can be compared with the recorded images in robot database. It can be used for assembling purpose.

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