UltrasonicDistanceMeasurementusingArduino

AimandObjective:

Theaimofthisprojectistoteachstudentsthedesignprocessofcreating Arduino-basedsensorsthatcanperformspecificfunctions.Theobjectivesofthisprojectareasfollows:

- TounderstandthedesignprocessofArduino-basedsensors.
- ToapplyTinkercad-basedsimulationtoreal-timeimplementations.

1. ProblemStatement:

Iidentifiedtheproblemofaccuratelymeasuringdistancesinreal-time,whichiscrucialinvariousindustriessuchasrobotics,automation,andsecurity.Theconventionaldistancemeasuringmethodsarenotalwaysreliableandefficient,especiallyinenvironments whereaccuracyisofutmostimportance.

2. IdentificationoftheNeed:

Ifocusedontheneedtodevelopareliableandefficientmethodformeasuringdistancesinreal-time.Idiscussedtheneedtocreateadistancemeasuringdevicethatcanbeusedinvariousapplicationsandcanprovideaccurateandreliablemeasurements.

3. StudyofthePre-existingSolutions:

Iconductedresearchonthepre-existingsolutionsfordistancemeasurement,suchaslaser-basedandinfrared-baseddistancesensors.However,thesesolutionsareexpensiveandnotsuitableforourrequirements.Ithendiscoveredultrasonicsensors,whichareaffordableandsuitableforourneeds.

4. ComparetheNeedwiththeExistingSolutions:

Icomparedourneedwiththeexistingsolutionsandfoundthatultrasonicsensors Arethemostsuitableforourrequirements.TheyAreaffordable,accurate,andreliable.

5. IdentifytheRequiredSpecifications:

Ibrainstormedandidentifiedtherequiredspecificationsforourultrasonicdistancemeasurementdevice.Theseincludedtherangeofthesensor,theaccuracyofthemeasurements,andtheoutputformat.

6. FindtheRelatedSoftware/Hardware:

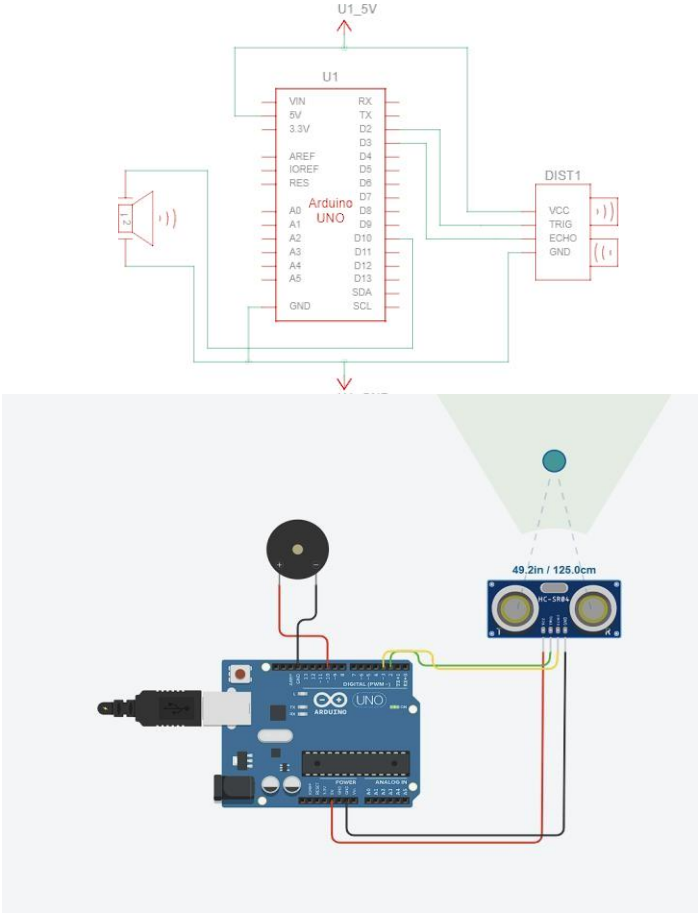
IidentifiedtheArduinoplatformasthemostsuitableforourproject,andIusedtheTinkercadsimulatortocreateandtestourproject.

7. SketchtheDesignProcess(Flowchart/ProcessDiagram):

Idrewaflowchartandprocessdiagramtovisualizethedesignprocessofourultrasonicdistancemeasurementdevice.Iidentifiedthedifferentscreensandtheirinterconnections,theworkingofthepushbuttonandcombobox,andthejumpingacrossthescreens.

8. DrawtheInterfaces:

Ioptimizedtheinterfacesofourdevicebydrawingroughinterfacesforthevariousscreens.Iensuredthattheinterfaces Areuser-friendlyandeasytonavigate.



9. Coding/Implementation:

IcodedtheinterfacesusingtheTinkercadsimulator,incorporatingtheultrasonicsensortomeasuredistancesinreal-time.Itestedthedeviceandmadenecessaryadjustmentstoimproveitsaccuracy. Followingcodewasimplementedfortheworkingofproject:

```
int trigger_pin = 2;
int echo_pin = 3;
int buzzer_pin = 10;
int time;
int distance;
void setup()
{
        Serial.begin (9600);
        pinMode (trigger_pin, OUTPUT);
        pinMode (echo_pin, INPUT);
        pinMode (buzzer_pin, OUTPUT);
}
void loop()
{
    digitalWrite (trigger_pin, HIGH);
    delayMicroseconds (10);
    digitalWrite (trigger_pin, LOW);
    time = pulseIn (echo_pin, HIGH);
    distance = (time * 0.034) / 2;

  if (distance <= 10)
        {
        Serial.println (" Door Open ");
        Serial.print (" Distance= ");
        Serial.println (distance);
        digitalWrite (buzzer_pin, HIGH);
        delay (500);
        }
  else {
        Serial.println (" Door closed ");
        Serial.print (" Distance= ");
        Serial.println (distance);
        digitalWrite (buzzer_pin, LOW);
        delay (500);
       }
}
```

10. Learning:

Throughthisactivity,IlearnedthedesignprocessofcreatingArduino-basedsensors,includingproblemidentification,needanalysis,solutioncomparison,specificationidentification,software/hardwareidentification,andinterfacedesign.IalsolearnedhowtoincorporatesensorsinourprojectandtestthemintheTinkercadsimulator.Overall,thisprojecthelpedmedevelopmyskillsindesigningandimplementingArduino-basedprojects.

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