

Theory Assignment 3

Assignment Title: Waste Management System

Section: 06

Group members:

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1. Introduction:

For ages us human beings are facing a problem, no matter where you go in this world you will have to encounter it one way or the other. Some countries barely figured out a way to handle it, but the others are still struggling. The problem we are talking about today is the problem of waste management. In a developing country such as Bangladesh you will see waste everywhere, although government have taken many initiatives, it is the human nature that is keeping the problem persistent. With our project we are aiming to change the human habit of littering, by making waste disposal easier, convenient and fun.

This project will use passive infrared sensor to automatically detect human presence to conveniently receive wastage, in addition it will use inductive motion sensor to automatically detect metal object which can sort recyclable trash. Furthermore, a level sensor will be added to warn users if the wastage disposal is nearly full.

2. Application Area:

We can implement it in dumpsters in public places such as street, parks, stadiums, auditoriums where there is mass public gathering and high chance of littering the environment and the surroundings. It can also be used in home for wastage disposal. With a little bit of tweaking big factories and industries can use it for waste management as well.

3. Technology and tools:

The sensors used here are:

- Passive Infrared Sensor (PIR Motion Sensor)
- Inductive proximity Sensor
- Ultrasonic Level Sensor

In addition to that we are using:

- Arduino UNO
- Power Supply (Battery)
- A container

4. Programming language:

We have used C++ to program Arduino UNO which communicates with our sensors.

5. Working mechanism of Sensors:

- **Working mechanism of PIR sensor**

The garbage disposal management system uses three sensors. Firstly, a PIR or passive infrared sensor to detect the presence of human, this feature makes it easy for user to get rid of rubbishes especially when a person has both arms occupied. The thermal PIR sensor can detect human temperature radiating as a form of infrared radiation emitting from human body. It has three pins, the signal pin will be connected with a microcontroller and whenever it detects a signal, the signal pin goes high.

- **Working mechanism of Inductive Proximity Sensor**

One of the main objectives of making the smart garbage disposal management system is not only making it easier and convenient to use, but making it environment friendly. An inductive proximity sensor comes in handy regarding managing the recycling part, since it can detect metal. Another benefit of using this particular sensor is that it doesn't interfere with dirt or grease, making it immune to dirt which is perfect to work inside a garbage disposal. It can even detect metals inside plastic or other non-metal objects. The proximity sensor creates a symmetrical oscillating magnetic field to detect metallic objects; the difference in amplitude of electricity points out the presence of metal. Inside the garbage can, a latch will support metallic objects to separately store them.

- **Working mechanism of Ultrasonic level sensor**

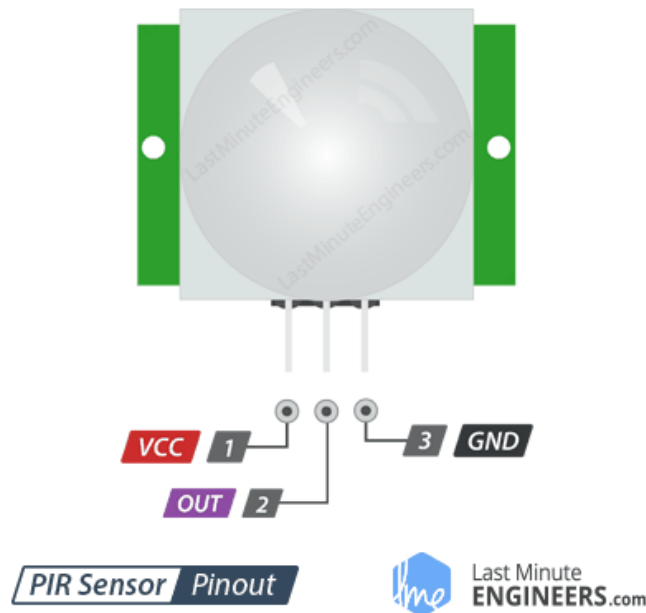
The ultrasonic level sensor uses ultrasonic sound to measure distance so it can calculate the level of any object, In the case of smart disposal management systems, it can calculate the distance over time between the sensor and scraps. Furthermore, this information will be shared to the user so they can get easily warned if the capacity is nearly full and manage it beforehand. The ultrasound level sensor doesn't interfere with dust particles, making it ideal in usage of messy situations such as inside a dustbin. It can also detect glass or liquids, so any kind of wastage will be detected.

6. Connection with ICs

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Data flow from sensors through ICs to I/O devices:

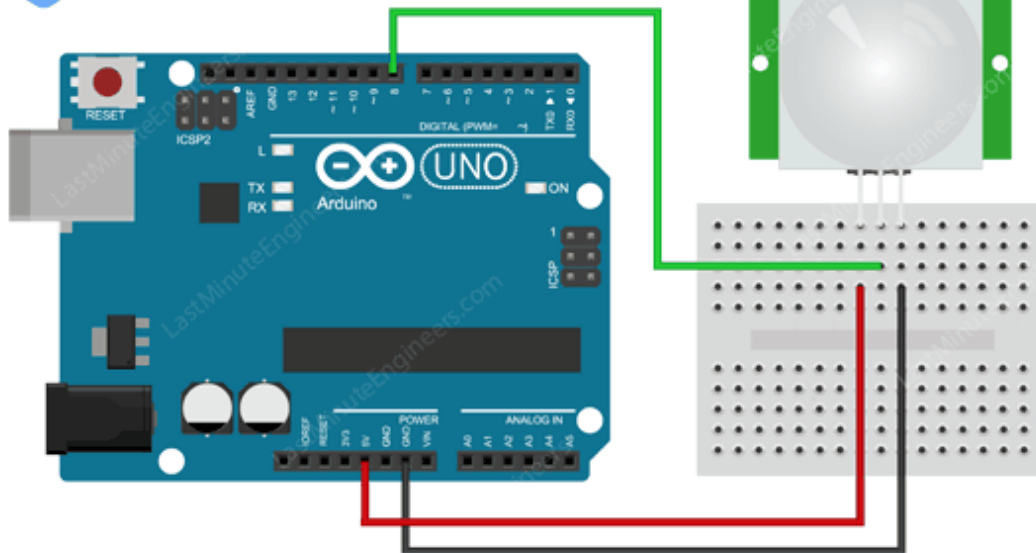
Wiring HC-SR501 PIR with Arduino: As we know that every human body emits heat and to detect any human or animal HC-SR501 is a very good choice. That's why we are choosing this sensor to detect humans. When a human passes through this sensor, it intercepts one half of the PIR sensor and positive differential changes happen between two halves. When humans leave the sensing area then negative differential changes happen between these two halves. Positive changes create high on output pin and negative changes create low on output pin.



VCC is the power supply for HC-SR501 PIR sensor which we connect the 5V pin on the Arduino.

Output pin is a 3.3V TTL logic output. LOW indicates no motion is detected, HIGH means some motion has been detected.

GND should be connected to the ground of Arduino.

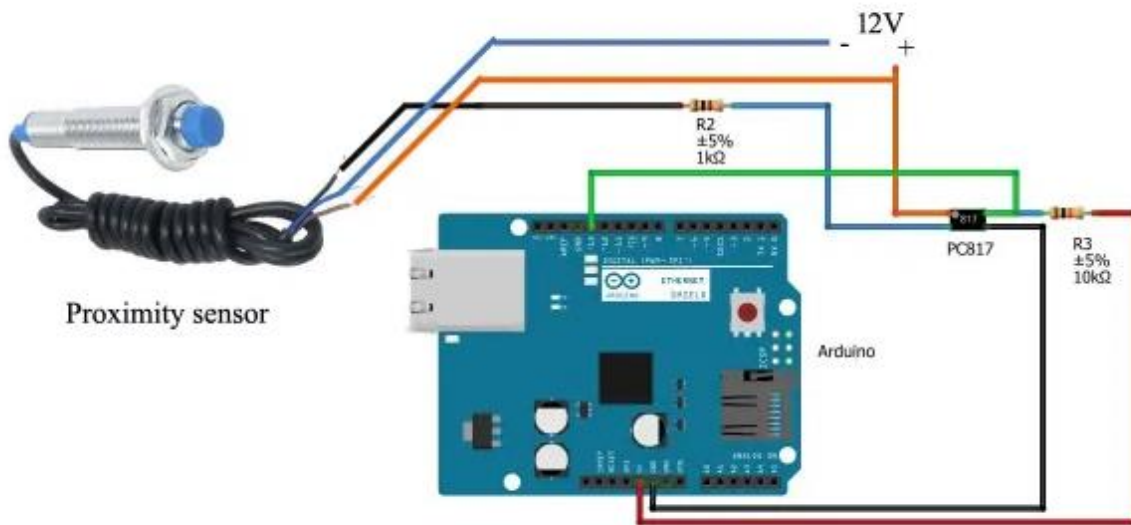
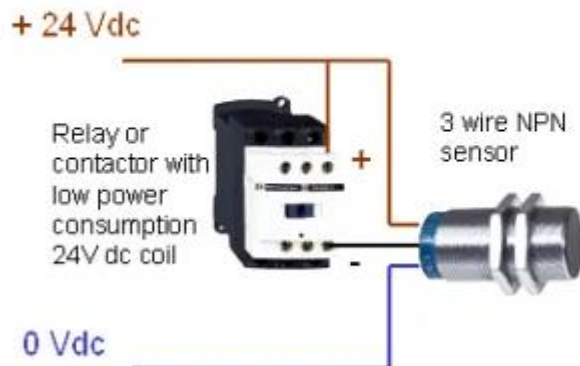


Wiring PIR Sensor to Arduino UNO

Connecting the PIR sensor to ARDUINO UNO is not so complex. First of all, we need to connect power with 5V and ground with ground and a digital pin to output so that we can see the positive and negative changes.

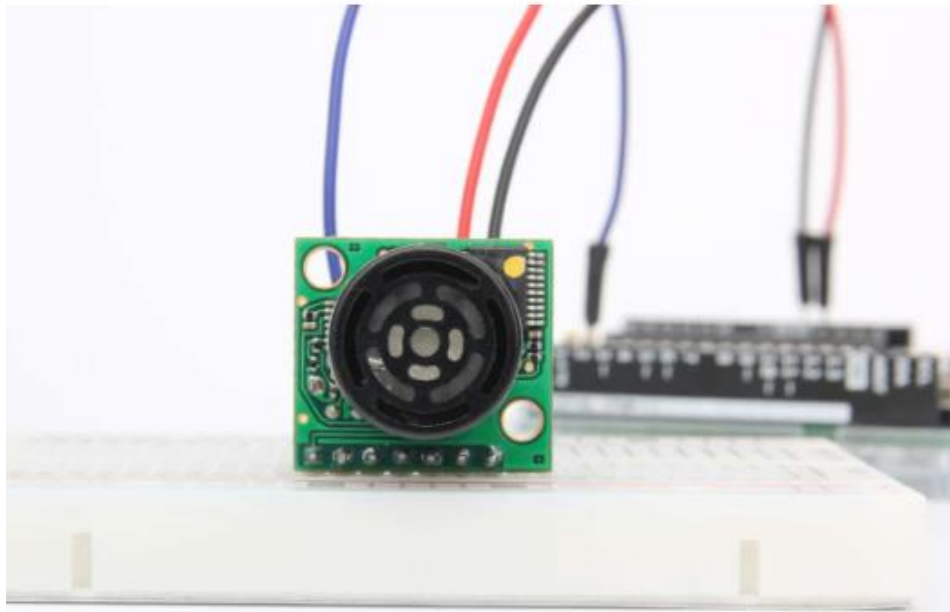
Wiring Inductive proximity sensors with Arduino: Here we use an inductive proximity sensor to detect metal objects so that we can recycle the trash. It can detect the target object from 0.5 millimeters to 40 millimeters. Here we use a NPN type inductive sensor which will give a 0 or ground in detecting any metal.

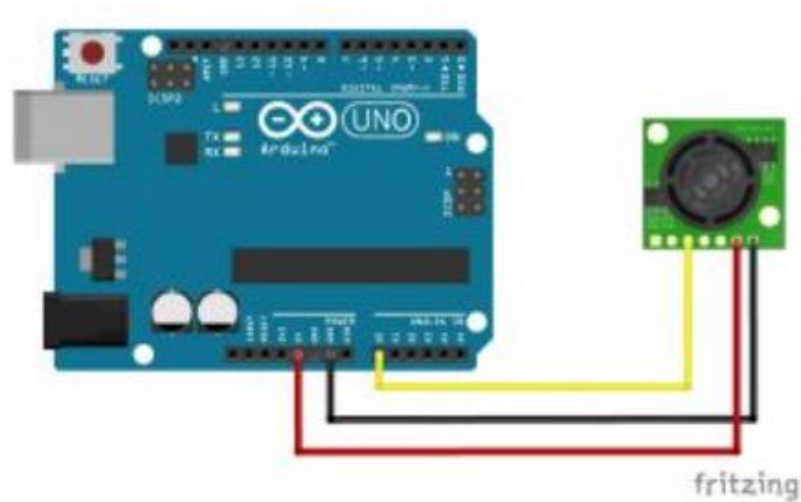
3 Wire NPN



At first, connect $1\text{K}\Omega$ resistor with pin number 2 of the PC817 and connect other terminal of the resistor with the black wire of the sensor. Then connect pin number 4 of the PC817 with the $10\text{K}\Omega$ resistor and connect other terminal of the resistor with 5V of the Arduino. After that, connect pin number 3 of the PC817 with the ground terminal of the Arduino. Connect the blue wire with the ground terminal. Lastly, connect pin number 1 of the PC817 with the 12 V power supply and connect the brown wire of the sensor with the +12V.

Wiring MB1240 Ultrasonic Sensor: Now we use our last sensor, MB1240 ultrasonic sensor which is used to detect the level of our wastage disposal whether it is full or not. When the ultrasonic waves get reflected by objects and ultrasonic sensor receives that signal and show output. By measuring how much time passed between sending and receiving the sound waves, we can calculate the distance between the sensor and the object.





Pulse width wiring diagram

MB1240 Connections – Pulse width

MaxBotix MB1240 Sensor

GND

V+

Pin 2

Arduino

GND

5 V

Pin 2

There are basically 3 pins that have this sensor, ground, VCC and output pin. Ground pin is connected with Arduino ground pin, V+ is connected with 5V and pin2 is connected with Arduino Pin2.

7. Estimated cost analysis:

- Passive Infrared Sensor (PIR Motion Sensor) – 98 BDT
- Inductive proximity Sensor – 1140 BDT
- Ultrasonic level sensor - 850 BDT
- Arduino UNO – 1045 BDT
- Power Supply (Battery) – 880 BDT
- A container to contain the waste - 620 BDT

Total estimated cost is 4000 - 4500 BDT.

9. Responsibilities of each member:

We have conducted our meetings in google meet, where we discussed about the project.

Kh Fardin Zubair Nafis: has worked on Working mechanism of Sensors, Connection with ICs (half)

Rakibul Anam Rohid: has worked on Introduction, Application Area, Technology and tools, Programming language

Sharif Al Musfique: has worked on Data flow from sensors through ICs to I/O devices, Connection with ICs (half)

Syeda Maisha Tarannum: has worked on Estimated cost analysis, Responsibilities of each member, Workplan (Gantt Chart), Conclusion

10. Workplan (Gantt Chart):

Workplan (Gantt Chart)

For Theory Project :

			Week-1							Week-2						
			1	2	3	4	5	6	7	8	9	10	11	12	13	14
Activity	Start	End	T	F	S	S	M	T	W	T	F	S	S	M	T	W
Research	15 April	16 April														
Group meeting	17 April	17 April														
Getting information	18 April	19 April														
Final meeting	20 April	22 April														
Final project	23 April	25 April														

11. Conclusion:

Nowadays Covid-19 is increasing rapidly and it spreads so easily. So, this touchless automatic waste management ensures the safety of the individual person as well as the whole community. This type of system can be used anywhere like home, hospital, mall and so on. Since, it is very cheap and affordable, all kinds of people can use it for safety purpose.

13. References:

1. <https://www.eaton.com/us/en-us/products/controls-drives-automation-sensors/sensors---limit-switches/inductive-proximity-sensor.html>
2. <https://www.engineersgarage.com/passive-infrared-sensor-pir-sensor>
3. <https://www.keyence.co.in/ss/products/sensor/sensorbasics/ultrasonic/info>
4. <https://lastminuteengineers.com/pir-sensor-arduino-tutorial/>
5. https://www.electronicclinic.com/proximity-sensors-inductive-and-capacitive-proximity-sensors-with-arduino/#Inductive_sensor_with_Arduino
6. <https://www.maxbotix.com/articles/mb1240-ultrasonic-sensor-arduino.htm>