



CSE360: Computer Interfacing

Theory Project

Team members:

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Theory Section: 07

Submitted to:

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Project Title: Laboratory based Security System

Introduction:

In this modern era, having a strong security system is like a bliss to us whether it's for our home, office or laboratories and to make the best use of it we are going to build a lab based security system in this project. As in the laboratories there will be so many private research files, raw materials, strong chemicals and if this goes in the wrong hands this can be a massive threat for us. Therefore, to decrease the risk of hampering the chemicals, equipment's and to save the confidential files we are going to use three sensors which are a proximity sensor, a door sensor, a fingerprint sensor, an Arduino Uno and some other equipment's to ensure more safety in the labs.

Application Area:

Since our main goal was to build a low cost yet very efficient security system so that everyone can afford it to secure their safety. Moreover, our system is structured with sensors that can be used in various fields like office buildings, private properties, machine factories to avoid robbery and damages by securing the buildings. For example, the factories can use our system to detect any nearby metal object so that no one can damage it by touching. Moreover, the private properties and office buildings can implement our security system to exclude the unwanted obstacles and members which can be identify by the sensors such as everyone needs to confirm their identity through the fingerprint before entering the room and the sensor will identify whether the person is authorized or not and if any outsider tries to get into the room, then the system will trigger the buzzer and also the LED light will be on to alert everyone. Thus our system will continuously check for the danger and will provide safety by securing the area.

Technology and Tools:

- Arduino Uno
- Proximity Sensor
- Door Sensor
- Fingerprint Sensor
- Breadboard
- Wires
- LED
- Buzzer

Programming Language:

As we are using an Arduino Uno to implement our coding part of this project, that's why we thought of using the C language as it's easier to use.

Working mechanism of Sensors:

- 1. Proximity sensor:** A proximity sensor is a device that can detect or sense the approach or presence of nearby objects and for this it does not need physical contact. There are two types of proximity sensor inductive proximity sensor and capacitive proximity sensor.

Working mechanism of inductive proximity sensor: A inductive proximity sensor can detect metal targets approaching the sensor without physical contact with the target. A high frequency magnetic field is generated by coil L in the oscillation circuit. When a target approaches the magnetic field, an induction current flows in the target due to electromagnetic induction. As the target approaches the sensor, the induction current flow increases which causes the load on the oscillation circuit to increase. Then the oscillation stops. The sensor detects this change in the oscillation status with the amplitude detecting circuit and outputs a detection signal.

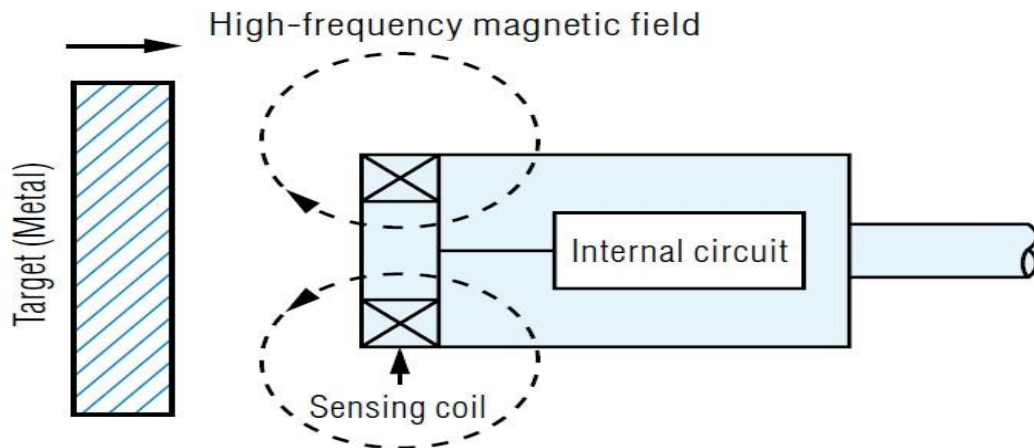


Figure: Inductive proximity sensor

Working mechanism of capacitive sensor: Capacitive proximity sensors are non-contact devices that can detect the presence or absence of virtually any object regardless of material. A capacitive sensor acts like a simple capacitor. A metal plate in the sensing face of the sensor is electrically connected to an internal oscillator circuit and the target to be sensed acts as the second plate of the capacitor. Unlike an inductive sensor that produces an electromagnetic field, a capacitive sensor produces an electrostatic field. The external capacitance between the target and the internal sensor plate forms a part of the feedback capacitance in the oscillator circuit. As the target approaches the sensor's face, the oscillations increase until they reach a threshold level and activate the output.

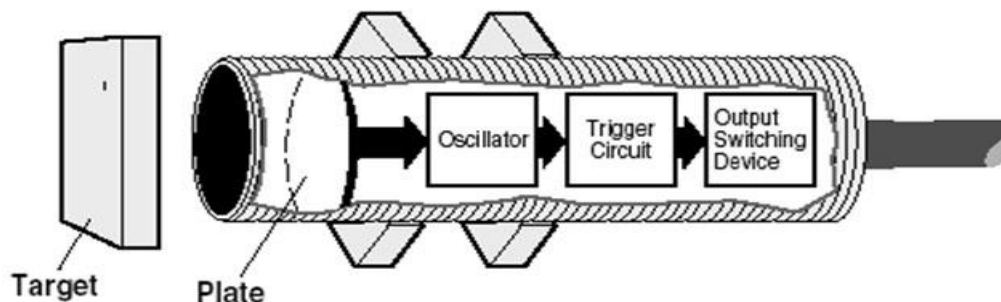


Figure: Capacitive fingerprint sensor

2. Door sensor: Door sensors sometimes known as photoelectric or infrared beam, electric safety door edges, door detector, electric proximity edges or electric doorman is an elevator device that detects a passenger or an objects on the doorway which prevents the doors from closing. If a person or an object blocks the doorway and the sensors detects the person or object, the door will reopen then stays open and will not closed until the person moves away or the object is removed from the doorway. If the doors are being held open for a more than the specified period, the elevator will go into nudge mode and the doors will close slowly with a continuously beep. Door sensors are also possible to detect an object or obstacle blocking the doorway.

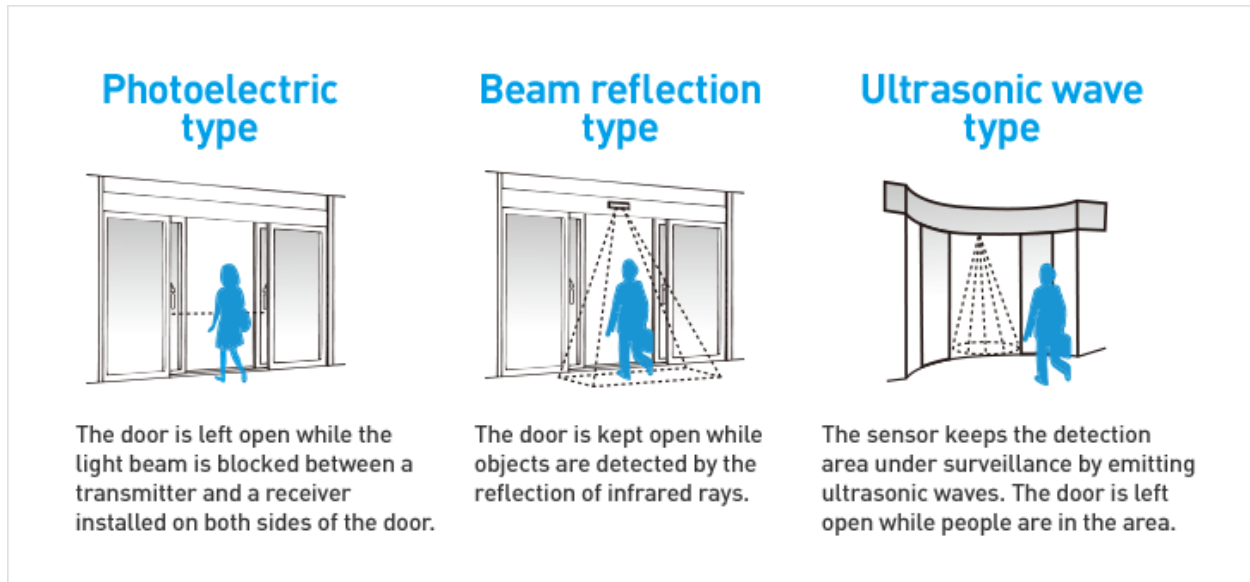


Figure: Door sensor

3. Fingerprint sensor: Two most common fingerprint sensors in use today are optical sensors and capacitive sensors.

Working mechanism of Optical sensor: The way an optical scanner works is by shining a bright light over anyone's fingerprint and taking a digital photo. The light-sensitive

microchip makes the digital image by looking at the ridges and valleys of the fingerprint, turning them into 1's and 0's and creates the user's own personal code.

An optical sensor.

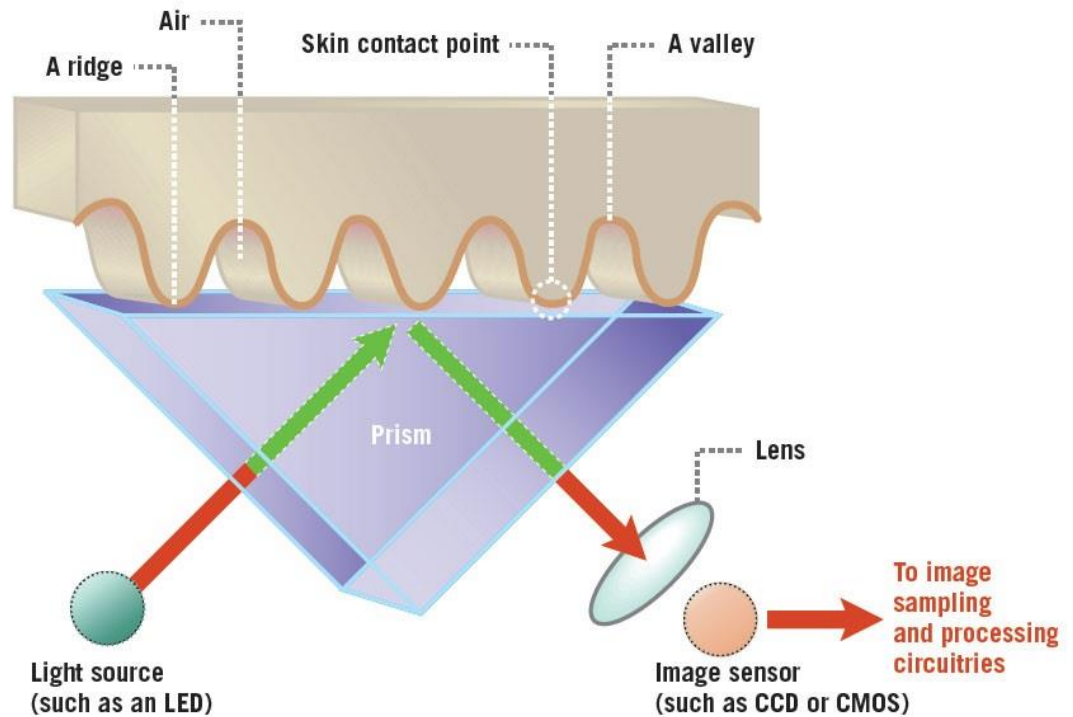


Figure 2

Figure: Optical fingerprint sensor

Working mechanism of Capacitive fingerprint sensor: Capacitive fingerprint scanners are more common and found on phones. The capacitive fingerprint scanner uses tiny capacitor array circuits that track the detail of a fingerprint. It uses the ridges of anyone's fingerprint that is placed over the conductive plates which changes the charge stored in the capacitor. While the valleys (air gaps) leave the charge on the capacitor unchanged. An operational amplifier integrator circuit tracks these changes that can then be recorded by an analog-to-digital converter where this digital data can be analyzed.

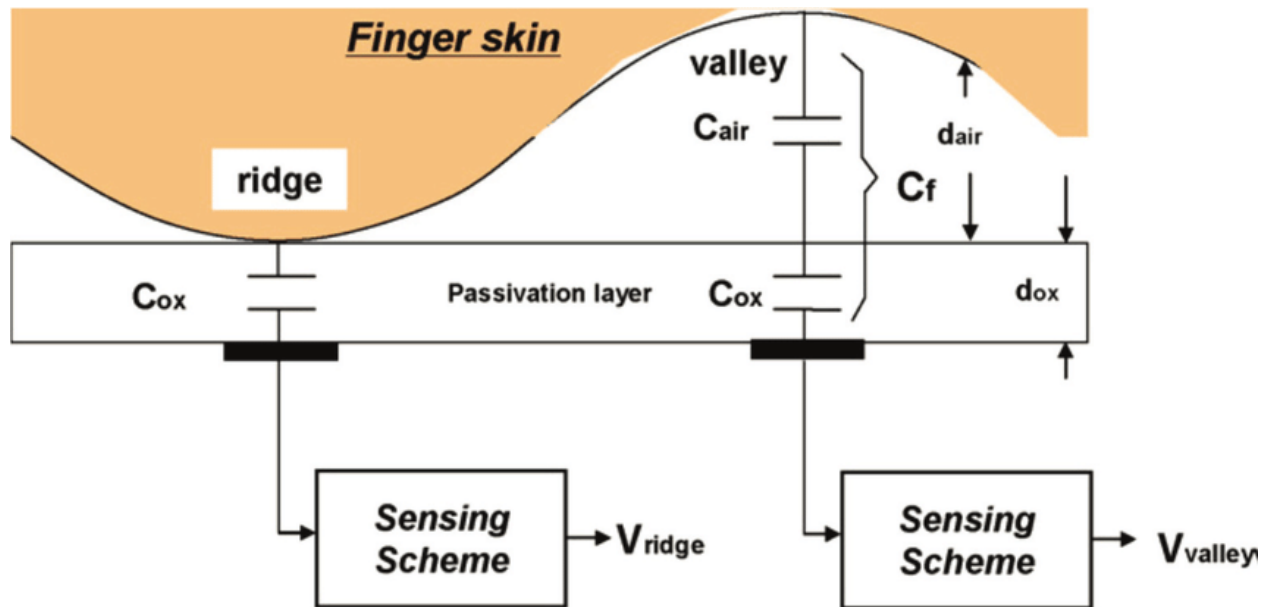


Figure: Capacitive fingerprint sensor

Connection with ICs:

Proximity Sensor: The black wire of the proximity sensor is connected to the Arduino analog pin A0. Also, the blue wire is connected to Arduino GND pin and the brown wire of proximity sensor is connected to the Arduino +5V pin.

Fingerprint Sensor: VCC pin of the fingerprint sensor is connected with +5V of Arduino. Then, TX and RX pins of fingerprint sensor is connected with RX and TX pins of Arduino respectively. Lastly, GND of fingerprint is connected with Arduino GND.

Door Sensor: One pin of the reed switch of door sensor is connected to the GND of Arduino and another pin of reed switch is connected with the input pin of Arduino with a pull-up resistor.

LED: Positive pin or the long legs of LED is connected with Arduino pin 13 and negative pin or short leg is connected with Arduino GND.

Buzzer: The negative pin of buzzer is connected to Arduino's GND and positive pin is connected with pin 12 of Arduino.

Data flow from sensor through ICs to devices:

First, when a person enters, he has to go through metal detector which has proximity sensor in it, it checks for harmful object or metal. if it detects something it contacts authority and terminate the process or else it sends approval to next door. Door system 1 waits for approval if no door remain shut, if yes it scans with IR to detect presence. Presence found then open door to count for 1 approval after counting 1 door shuts down else open to person to continue next step. For next step, person has to scan his fingerprint and if it matches it send door to approval and to complete the process in previous way if not matched it will turn on a warning light and buzzer to send sound.

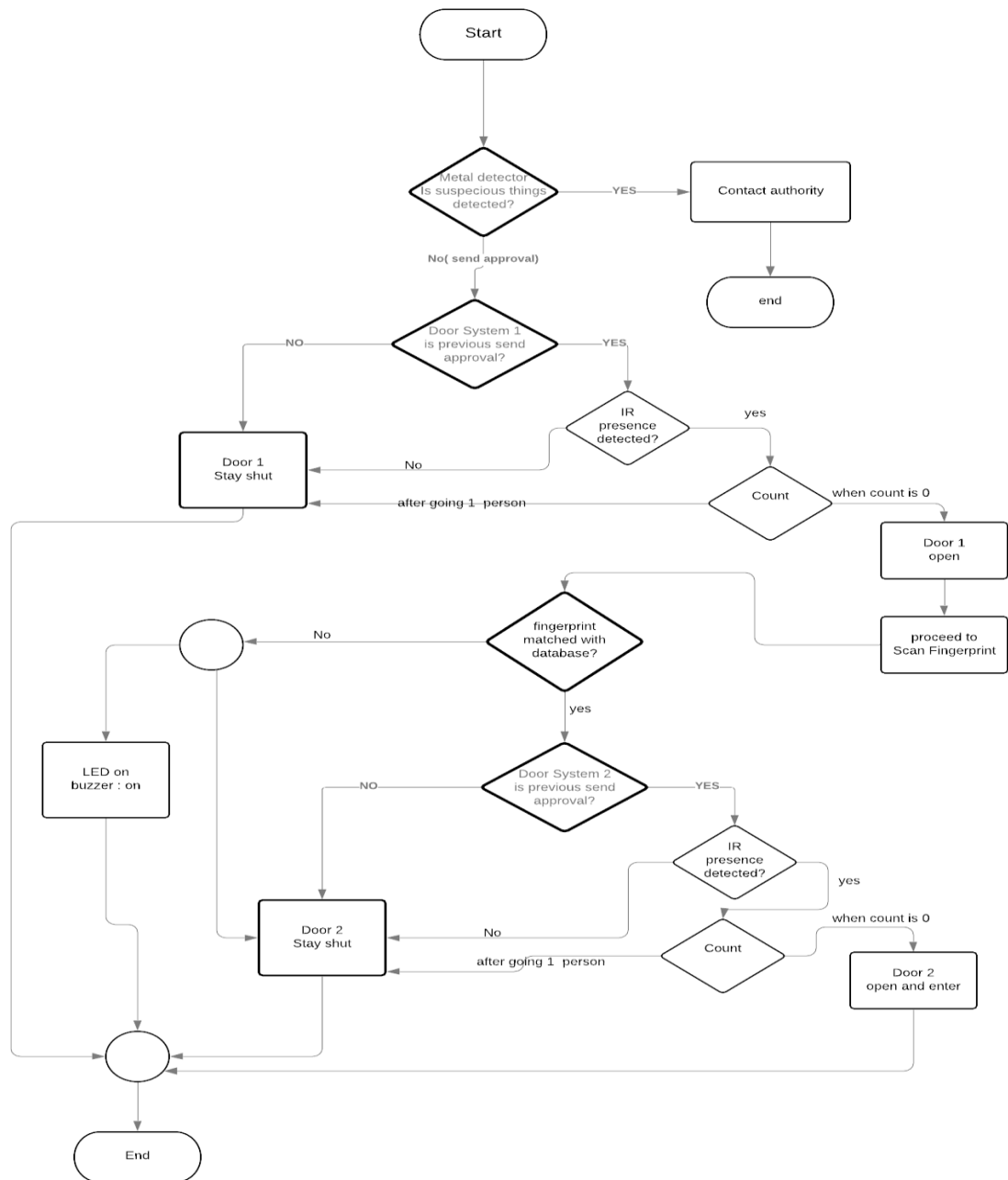


Diagram: Data flow from sensor through ICs to devices

Estimated Cost Analysis:

Equipment	Cost (BDT)
Arduino Uno	640
Inductive Proximity Sensor	342
Capacitive Proximity Sensor	705
Door Sensor	19,850
Optical Fingerprint Sensor	17,144.23
Capacitive Fingerprint Sensor	2,174
Breadboard	94
Wires	20
LED	5
Buzzer	15

These are the estimated prices and this may vary from shop to shop. This system will cost around 41,000 BDT. Capacitive proximity sensor is costly than inductive proximity sensor. But the Optical fingerprint sensor has a more sophisticated data reader, so it costs a lot more than Capacitive fingerprint sensor. We can also use some high cost sensors to build this system that will work more efficiently. As we can use wireless door sensors instead of wired door sensors. It will cost more.

Responsibilities of each member:

1. *Introduction, Application area, Technology and tools, Programming language* ➔ **Jannatul Farzana Tandra** – ID: 19101097
2. *Working mechanism of sensors* + Project Idea ➔ **Mahmudul Hasan Emon** – ID: 19101098
3. *Connection with ICs* ➔ **Md Ridwan Mahmud** – ID: 19101104
4. *Data flow from sensors through ICs to devices* ➔ **Jahid Hossain Sabit** – ID: 19101344
5. *Estimated cost analysis & Conclusion* ➔ **Sadia Sobhana Ridi** – ID: 18301279

Working plan:

Working Plan (Gantt Chart)			Week 1						Week 2							
			12	13	14	15	16	17	18	19	20	21	22	23	24	25
Activity	Start	End	S	M	T	W	T	F	S	S	M	T	W	T	F	S
Group meeting 1: Project selection	15th Dec	15th Dec														
Research work of the project	16th Dec	18th Dec														
Group meeting 2: Project selection	19th Dec	19th Dec														
Collecting all resources	20th Dec	21st Dec														
Making Final Project	22nd Dec	25th Dec														
Group meeting 3:	25th Dec	25th Dec														

Conclusion:

Security has become the major priority in most of the laboratories because laboratories have highly hazardous materials. To reduce this security problem, we can use this system. Nobody except the lab members will not enter the laboratory. We do not have to open the door every minute when someone comes as we used the door sensor here. For human safety, we also used proximity sensors. In short, the user will be benefitted.

Reference:

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5. https://www.researchgate.net/figure/4-The-conceptual-model-of-a-capacitive-fingerprint-sensor_fig3_285770473