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Access Control system with contactless temperature detection

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Abstract - : *The System proposed in this paper focuses on creating a secure environment for work places like offices, schools, restaurants and many other places where maintaining social distancing will be difficult. This project is based on most of the important measures to be taken to stay uninfected from Covid19. It consists of contactless temperature measurement, automatic sanitization, door access using RFID card with the help of interfacing between ATmega328p, Infrared temperature sensor, ultrasonic sensor.*

Key Words*: *RFID (radio-frequency identification)

1. INTRODUCTION

Coronaviruse is like certain species of animals, such as cattle and camels. Although the chances of transmission of coronaviruses from animals to humans is rare, we know this new strain likely came from bats, though one study suggests pangolins may be the origin. According to [1] when people with COVID-19 breathe out or cough, they expel tiny droplets that contain the virus. These spreads through air and enter the mouth or nose of someone, causing an infection in lungs. Other people can pick up the virus by touching surfaces or objects, which affected or in touch infirm person. A person with COVID-19 can Experience a wide range of symptoms like dry cough, Fever, sore throat often including a dry cough and shortness of breath [2].

Many people have work from home in this pandemic but not everyone have work from home. Everyone should take care of social distancing, COVID-19 symptoms include fever so temperature measurement is in must list. If person travel from home to office then many thing comes in contact which cause this problem, then sanitization helps to minimize the spreading of the disease. We all have observed that when the shops all around started to open, we followed social distancing, contact less sanitization .Regular temperature scanning at the entrance of shops using a thermal gun[3] which decreased the number of covid19 patients, but after sometime the seriousness was gone and we noticed a lot of people not taking precautions. As a result the covid19 patients have rose once again especially in Maharashtra.

The best way to stay safe in the current situation is to stay at home if we have a work from home alternative, but it isn't possible for all of us depending on our work. To maintain safety at work regular temperature check-up and regular sanitization of hands is of Utmost importance. Our project creates a more secured working environment by measuring the temperature of the user and then sanitizing the hands. Only then the user will be granted entry into the working place. This way we can be sure that the person who have entered the place, room, classroom, Cabin has normal body temperature and sanitized hands so if the person touches any object, there wouldn't be any risk of infection. It reduces the possibility of a potential sick person entering the place.

2. COMPONENTS

2.1 REGULATOR 7805

Voltage regulators are very common in electronic circuits. They provides a constant output voltage for varied input voltage. In our case the 7805 IC is an regulator IC that finds its application in most of the projects. The actual meaning of 7805, "78" means that it is a positive voltage regulator and "05" means that it provides 5V output. So our 7805 will provide a +5V output voltage.

The output current of IC 7805 can go up to 1.5A. But, the IC suffers from heavy heat loss hence a Heat sink is recommended for projects that consume more current.

Features:

- 5V Positive Voltage Regulator
- Minimum Input Voltage is 7V
- Maximum Input Voltage is 25V
- Operating current(IQ) is 5mA
- Internal Thermal Overload and Short circuit current limiting protection is available.
- Junction Temperature maximum 125 degree Celsius Available in TO-220 and KTE package

2.2 DRIVER ULN2003

We commonly use motor driver IC ULN2003 to drive high current loads using digital logic circuits like operational amplifiers, timers, gates, drivers, PIC, ARM etc. For example a RELAY that requires 12V and 300mA to run cannot be powered by a PIC I/O hence we use this IC to source enough current and voltage for the load. This driver IC is used to drive relay modules, motors, high current LEDs and stepper motors. So if we want to work with a circuit or device that uses more than 5V 80mA, we can use this driver IC.

The ULN2003 is a 16-pin IC. It consist of seven

Darlington pairs. Each Darlington pair is used to drive several loads up to 50V and 500mA. For these seven Darlington pairs it has seven input and output pins and a ground and common pin. The ground pin is grounded and the use of common pin is optional. This IC does not have any Vcc or power pin because the power required for the transistors to work will be drawn from the input pin itself.

Features:

- Contains 7 high-voltage and high current

  Darlington pairs
- Each pair is rated for 50V and 500mA
- Input pins can be triggered by +5V
- All seven Output pins can be connected to gather to drive loads up to (7×500mA) ~3.5A.
- Can be directly controlled by logic devices like Digital Gates, DRIVERS, PIC etc
- Available in 16-pin DIP, TSSOP, SOIC packages

2.3 LCD 16x2 ALPHANUMERIC

Now-a-days we usually use LCD modules in most projects that includes embedded systems. Because the LCD displays are available at cheap price and they are programmer friendly. We often use these displays in our day to day life, for example at PCO's or in calculators.

16×2 LCD is named so because; it has 16 columns and 2 rows. The combinations of number of columns and rows available are 8×1, 8×2, 10×2, 16×1, etc. Commonly we use LCD 16×2. It has 32 characters in total and each character will be made of 5×8 pixel Dots.

Features of 16×2 LCD module:

- Operating Voltage is 4.7V to 5.3V
- Current consumption is 1mA without backlight
- Alphanumeric LCD display module, meaning can display alphabets and numbers
- Consists of two rows and each row can print 16 characters.
- Each character is build by a 5×8 pixel box
- Can work on both 8-bit and 4-bit mode
- It can also display any custom generated characters
- Available in Green and Blue Backlight

2.4 RELAY

Relays are the switching devices that are commonly used in electronics circuits. There are two important parameters of relay, [1] Trigger Voltage; the voltage which is required to turn on the relay to change the contact from Common → NC to Common → NO. [2] parameter Load Voltage & Current is the amount of voltage or current that can be supplied to the NC, NO or Common terminal of the relay. For DC it is maximum up to 30V and 10A.

2.5 TRANSFORMER

A center-tapped transformer is used in rectifier circuits. It is also known as two phase three wire transformer. For digital use step down transformer is used to step-down the voltage and then convert it to DC by using a rectifier circuit. The peak inverse voltage of a center-tapped transformer is twice as PIV of bridge rectifier. Hence full wave rectifier circuits uses center tapped transformer.

The working of a center tapped transformer is similar to a normal secondary transformer. A primary voltage is induced in the primary coil and due to magnetic induction the voltage will be transferred to the secondary coil. In the secondary coil of a center tapped transformer, an additional wire is placed exactly at the center of the secondary coil, so that the voltage at center will always be zero. If we combine this zero potential wire with either primary or secondary winding, we will get a voltage of 12V AC. If this wire is ignored and voltage across primary and secondary is considered then we will get a voltage of 24V AC. This feature is helpful for the function of a full wave rectifier.

2.6 RFID READER

RFID stands for Radio Frequency Identification. The working of the RFID reader is based on the Radio frequency signals. These systems consists of RFID Reader and a tag which is used in identification and tracking of different type of objects. Now-a-days barcodes are used in a warehouse or a supermarket for identifying an item using a barcode scanner. This existing system can be replaced by the RFID technology. The RFID can give unique identification number to all products and the system can detect the RFID tag within its proximity range. With this feature most of the system can be automated because the tag can be scanned and billed automatically when it reaches the RFID reader. RFID door locks and RFID attendance system are very popular now days and many hotels provide RFID tag to their customer to lock and unlock the door.

An RFID get power from external power source and it active all the time. When switch ON, the oscillator generates signal with desired frequency. Generally if signal transmits directly the strength will be less but it can be maximized by connecting amplifier circuit and modulator to signal to a longer distance. The RFID reader signals are everywhere with it's proximity to detect a tag. When the tag comes in the

contact with RFID reader, it read the data from coil present in it and transfers the RF signal to electrical signal. This signal power up the microchip which presents in the tag.

RFID reader also has a transceiver in it. When signal comes back from tag through antenna of RFID reader and then decoded the signal by decoder, results original data can be obtained and then proceed by microcontroller to perform next task. There are two types in RFID tag [1] Passive, which explained above and [2] Active, which detect the signal from reader only to trigger the circuit.

2.7 ATMEGA328 microcontroller

The ATEGA328 microcontroller is made by Atmel. It is an 8-bit AVR RISC-based microcontroller which combines 32 KB ISP flash memory, 1 KB EEPROM, 2 KB SRAM. This microcontroller has 23 general purpose I/O lines and 32 general purpose working registers. There are three flexible timer/counters with different number of modes. It also supports internal and external interrupts. It has serial programmable USART, a byte-oriented 2-wire serial interface, SPI serial port, 6channel 10-bit A/D converter (8-channels in TQFP and QFN/MLF packages), programmable watch-dog timer with internal oscillator, and five software selectable power saving modes. The device operates between 1.8-5.5 volts.

Features:

- Flash memory: 32 KB
- SRAM: 2 KB
- EEPROM: 1 KB
- Pin count: 28 or 32 pin
- Maximum operating frequency: 20 MHz
- Number of touch channels: 16
- Maximum I/O pins: 23

2.8 ULTRASONIC SENSOR

An ultrasonic sensor measures the distance of a target object by emitting ultrasonic sound waves, and converts the reflected wave into an electrical signal. The travelling speed of ultrasonic waves is faster than the audible sound . Ultrasonic sensors have two main parts. 1) The Transmitter, which emits the sound using piezoelectric crystals . 2) The Receiver, which encounters the sound after it has travelled to from the target.

Ultrasonic sensors are used primarily as proximity sensors. They can be found in vehicle for self-parking technology and anti-collision safety systems. In comparison to infrared (IR) sensors in proximity sensing applications, ultrasonic sensors are not as sensitive or capable to interference of smoke, gas, and other parameters.

Ultrasonic sensors are also used as level sensors to detect liquid levels in closed containers (such as vats in chemical factories). Mostly, the ultrasonic technology used in medical industry to produce images of internal organs, identify tumors, and ensure the health of babies in the womb.

2.9 IR TEMPERATURE SENSOR

The sensor which measure the temperature without contact i.e. measures the temperature from a distance is called thermopile. These sensors measure the temperature by measuring infrared energy of an object. The IR energy increases with the increase in the temperature of the object. The element which senses the temperature consists of small thermocouples on a chip of silicon. It produces an output by absorbing the energy. These type of sensors which measures the temperature in contactless way have a lot of applications in pyrometer in industries, climatic control, and very common in medical field.

3. WORKING

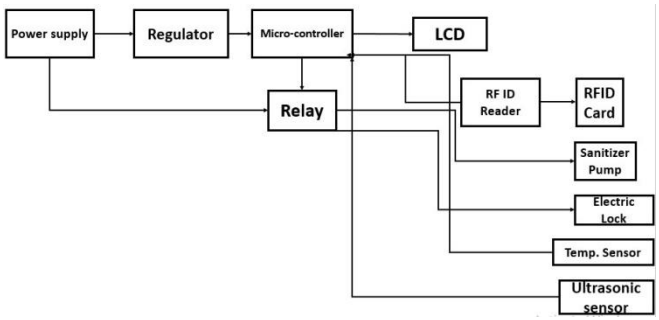

Fig -1: Block Diagram

We have used ATmega328p microcontroller which works on 5vDC. A 5vDC is generated by using 7805 regulator IC. 12vDc from battery is fed to the input pin (pin 1) of 7805, further this IC converts it into 5v and gives on pin 3. A capacitor C1 is used to filter any spikes/distortions comes due to electrical switching interferences. Capacitor C2 is used as a storage, as regulator IC 7805 is the only 5v generator in this circuit and all the component like Arduino, LCD, Sensors, etc. works on 5dc, in case of excessive requirement of 5vdc , a capacitor C2 fulfill it. After getting power supply ON, controller check the signal coming from Ultrasonic Sensor, Temperature Sensor.

The ultrasonic sensor used in our circuit works on the same principles as a radar system. An ultrasonic sensor can convert electrical energy into sonic waves and vice versa. The sonic wave signal traveling at a frequency above 40 KHz. The microcontroller sends a trigger signal to ultrasonic sensor for measuring the distance. The duty cycle of this trigger signal is 10µS (for the ultrasonic sensor). When it's triggered, the ultrasonic sensor generates eight acoustic (ultrasonic) wave which initiates a time counter. When the reflected (echo) signal is received, the timer stops. The output of the ultrasonic sensor is a high pulse with the same duration as the time difference between transmitted ultrasonic bursts and the received echo signal. The Temperature sensor used in this project is non-contact type

sensor. This sensors work by focusing the infrared energy which is emitted by an object on one or more photo-detectors. These photo-detectors convert that energy into an electrical signal, which is proportional to the infrared energy emitted by the object, because the emitted infrared energy of any object will be proportional to the temperature of the object, the electrical signal provides an accurate reading of the temperature of the object. The infrared signals are passed into the sensor through a window which is made out of special plastic. Plastic does not allow to pass infrared frequencies through it, but the sensors use a form which is transparent to particular frequencies. This plastic filters the unwanted frequencies and also protects the electronics inside the sensor from dust, dirt, and other foreign objects.

An RFID Reader is used to detect the RFID card, once the RFID reader detects the card data and send it to microcontroller. Further controller check the validity and start to perform Lock Opening. As Lock used in our project is work on 12vDC and microcontroller doesn't drive the lock directly, hence a Driver IC is used.

While driving the loads which are controlled (switched ON or OFF) using microcontroller, for this purpose the circuit requires relays, acting as controlled switches (for different circuits different types of relays are used). The relay controls the load which the signal received from the microcontroller or other circuits. Whenever it gets control signal the relay gets activated and loads can be turned ON or OFF. But, firstly we must know what a relay driver circuit is. The relay driver circuit can be designed using various integrated circuits which used for driving a relay. It is necessary for relays to be driven for activating or to turn ON. Therefore, relays require some driver circuitry to turn ON or OFF.

In our project two relays are used to drive LOCK and Sanitizer PUMP. Sanitizer Pump is used to spray the sanitizer if the Temperature detected by temperature sensor of person is normal.

LCD is used to display all the processes like Temperature, Distance, PUMP-ON/Off, RFID card Number, Lock ON/Off etc.

4. CONCLUSIONS

The Process will start when the sensor will scan temperature of the user .Once the temperature is verified the system will go to next step i.e. RFID detection and attendance will be marked The next step will be sanitization.

Hand sanitization will be the last condition to be satisfied before the access is granted .In case of emergency, one Master card will be available which will not require any condition for access with an exception of sanitization.

There are three possible cases with RFID cards

1) Registered card- In this case the card will be identified and the number will be displayed on the screen and followed by hand sanitization.

2) Unregistered card- In this case the first step will be temperature measurement. If the card in use is not registered then the process will stop immediately.

3) Master card- Master card will be an exception where temperature measurement will not be mandatory. The door will unlock immediately after the card has been scanned but only after sanitization.

Exit Switch: The person who has entered the place or the room will be able to exit with the help of an exit switch which will unlock the door for 5 seconds. The entire process will take place within 25-40 seconds.

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