Noval Automatic Water Dispenser and Sanitizer with Infrared Human Temperature Sensor Using Arduino

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Abstract **- Breaking the chain of community transmission is one of the best precautions to COVID- 19 spread. In this work, a novel automatic water dispenser and sanitizer with infrared human temperature sensor using Arduino for community spread chain breaking is proposed. In this work, an Infra-red PIR sensor is utilized to sense the human presence. After the defined period of human presence sensed by the sensor, the water pump will be ON for five seconds, which will pump water for five seconds to wash the hands and pause for 3 seconds to wipe the hands. After that, it pours the required amount of hand sanitizer from the sanitizer container attached to the stepper motor unit. During this process, the human temperature sensor also senses body temperature. If the temperature exceeds the limit (98.6 o F) it will forward the alert message to the doctor's mobile phone using the GSM module also display an alert message in the LCD display attached with the processor with alarm.**

Index Terms **- Arduino Uno, GSM module, Human temperature sensor, PIR sensor, SPDT relay, Tinker cad.**

I.INTRODUCTION

COVID-19 has caused severe disruption across the world. In general, Europe, Asia and U.S have abided the effect of the infection, while Asian countries have been comparatively less death rate so far. The World Health Organization (WHO) has declared a pandemic over a new coronavirus which causes an illness known as COVID-19 that has spread to nearly every country. The disease has exterminated some 168,500 people and diseased more than 2.4 million, according to data compiled by Johns Hopkins University. Nearly 643,000 people have well again since February 2020. COVID-19 Community spread chain breaking is the ultimate motto of this work also it is the only way to prevent the COVID-19 spread till the invention of vaccination.

In this paper an Arduino processor [1] is used, it is a user-friendly microcontroller and simply do programming with freeware IDE, also it supports reprogramming at any instant of time. Arduino platform was introduced in 2005 with the motto of providing an inexpensive and easy way for students and professionals to develop innovative projects that interact with their environment using sensors and actuators. With the support of simple development boards, it can program electronic devices to monitor the environment, climate, etc. It is also acting as a minicomputer with dedicated operation such as other controllers by controlling electronics devices for the particular application. It also supports the transmission and reception of data over the internet with the help of various Arduino accessories such as GSM, IOT.

In the previous literature N Y W War et.al [2] controlled a stepper motor using arduino process with IR remote. Jothibasu M et al. [3] used ARM 7 processor to convert the room into smarter and it used power economically. V Bhatia et al. [4] presented a PIC microcontroller to control the security of elevator with mobile DTMF frequency. Xiaodong X et al. [5] presented a wireless LED display it controlled by the microcontroller through RF module. I. Panagopoulos et al. [6] presented a hybrid method co-design process to the micro controller. B. Ismail et al. [7] created a single-phase sinusoidal pulse width modulation (SPWM) microcontroller-based inverter.

II.HARDWARE REQUIREMENTS

The system mainly uses Arduino UNO processor, Relay for drive the external heavy motors of the circuit, LCD Display to display the result for understanding.

The lists of the component used to build the model are listed below.

- Arduino – UNO
- PIR Motion Sensor
- Stepper Motor

- LCD Display
- Mini DC Pump
- Human Body Temperature Sensor:
- GSM Module
- SPDT Relay

A. Arduino UNO

Arduino Uno is a micro controller-based development board ATmega328P [8]. It has 14 digital input/output pins (which includes 6 PWM pins, 2 transmission and reception pins), 6 analog inputs, a USB connector, and a reset button. It contains everything needed to support the microcontroller to perform various operations. It has a 32kb of flash memory to store the program that can be coded for the operation.

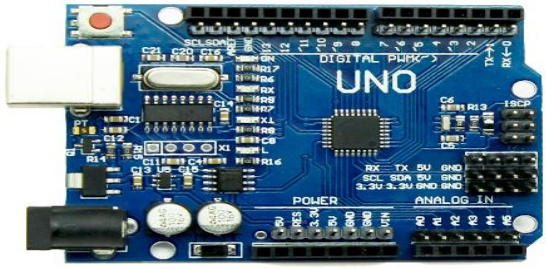


Fig. 1 Arduino UNO development board

B. PIR Motion Sensor

Fig 2. PIR motion sensor

This is a Pyroelectric sensor (PIR) module which is developed for human body movement detection and is also called Motion Sensor [9]. It can identify the motion by analysing the changes in the IR ray emitted from the source. It works from 3.3 V to 5 V DC and gives TTL output [15], it can detect human presence up to 7 meters with angle about 100 degree.

C. Stepper Motor

Fig .3. Stepper Motor

Motor converts electrical power into mechanical power, but stepper motor converts rotation into number of forward and reverse steps. The rotor is designed to rotate 15° for each input pulse that the motor receives. Hence it required 24 steps to make one 360 ^{0} (2415|) rotation. This work uses 12 steps forward and 12 steps reverse rotation to dispense and stop the sanitizer.

D. LCD – display

Liquid Crystal Display board is a two-row display, it can display 16 characters per row, each character position has 5x7 pixel matrix to display characters. It has 8 data lines it can use for both input and outputs (read and write). It can display both 8 bit and 4-bit character. It needs 5v supply to function also user can control its contrast.

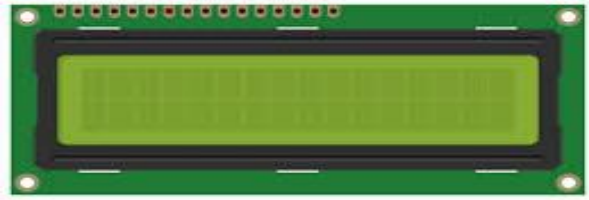


Fig 4. 16x2 LCD Display

E. Mini DC Pump

Fig 5. Mini DC Pump

In this work a low cost, portable, submersible Pump Motor is used. Its operating voltage is from 6 to 12 V. It has the pumping capacity of 120 litters of water per hour. For the precaution of motor, the water level must be kept always higher than the motor inlet level. Else it may cause damage the motor.

F. Human Body Temperature Sensor

Fig. 6. Clinical Thermometer MAX30205

The MAX30205 is a body temperature measuring sensor. It can measure the temperature range between 37°C and 39°C with accuracy of 0.1°C. It is an analogy sensor with the resolution of 16 bits [11].

G. GSM module

Fig..7: GSM Module

Global System for Mobile communication (GSM) makes the wireless communication between microcontroller and mobile phone.[12]. GSM is a digital system works under the principle of Time Division Multiple Access (TDMA) [16, 17,18]. It has duplex communication different time slot for uplink and down link with the data rate of 64 kbps to 120 Mbps. It can support various cell size such as macro, micro, pico and umbrella cells with the individual implementation domain.

H. SPDT Relay

The microcontroller provides only limited amount of current about 20mA. This limited current not enough to drive the motor having a current capacity of 1 A. So, in this work used a Single-Pole Double-Throw (SPDT) relay. SPDTs magnetic coil can energise by 5V output of microcontroller. So, it can provide enough current to the motor through NO (Normally Open) connection. The relay is normally in NC (Normally Closed) state when the controller energise its magnetic coil it provides high voltage it turns to the NO (Normally open) state also drive motor.

Fig..8: SPDT Relay

III. MATERIALS AND METHODS:

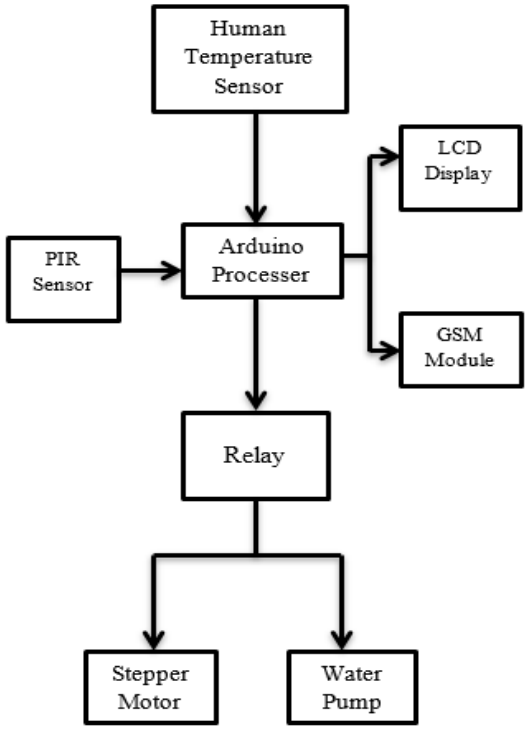


Fig.9. Block diagram of workflow

The flow of proposed model is shown in fig.9, In general, A tunnel is fixed in the vicinity of people gathering and peoples are allowed one by one through this tunnel. PIR sensor fixed in the tunnel entrance is sense the human entry up to 7 meters vicinity and it transfers the signal to the processor [14].

The processor waits for few seconds within that period the person reaches the wash basin kept within the tunnel (delay period can be assigned by the user dependents on the distance between tunnel entrance and wash basin).

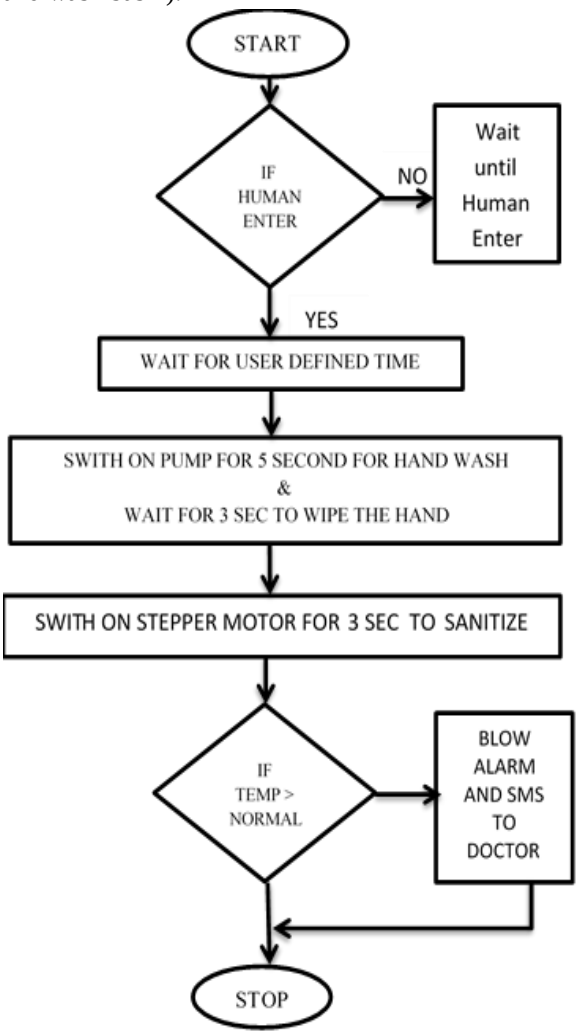


Fig.10. Flow chart of proposed method

After that time period the processor switch ON the pump for 5 seconds to pour the water and wait for 3 seconds to wipe the hands of the person who entered in the tunnel. After that the processor switch ON the stepper motor for 3 seconds forward direction to dispense the sanitizer attach with the stepper motor and stop the dispenser by reverse rotation of stepper motor for 3 seconds. While this process, the human body temperature measuring sensor available in front of wash basin sense the body temperature [19], if it exceeds the normal limit immediately it gives alarm in the speaker attached with the processor and also send alert message to the doctor ‘s mobile phone [20, 21].

A. Proposed Method Simulation Model in Tinker cad

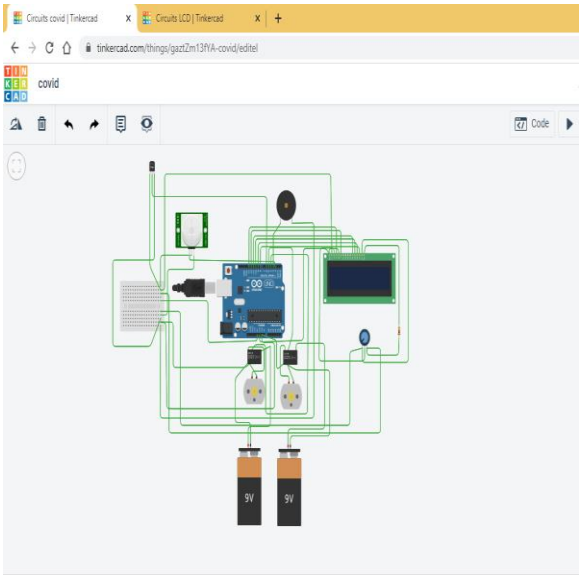


Fig.10: Proposed method in tinker cad

In this simulation because of the unavailability of water pump and human temp sensor simulation component DC motor and IR temp sensor is used.

B. Coding for LCD

The Tinker cad package provides graphical coding for arduino users, so it makes the code simple and user friendly even beginners practice this coding.

Coding for LCD display to display the temperature. [22].

```
#include<LiquidCrystal.h>
LiquidCrystal lcd (13, 12, 5, 4, 3, 2);
int temp = 0;
void setup ()
{
 pinMode(A1, INPUT);
 Serial.begin(9600);
 lcd.begin(16,2);
 lcd.print("Temp sensor");
}
void loop ()
{
 temp = - 40 + 0.878679 * (analogRead(A0) - 20);
```

```
  //Serial.println(temp);
  delay (10); // Delay a little bit to improve simulation
performance
lcd.setCursor(1,1);
  lcd.print("Temp= ");
  lcd.setCursor(7,1);
  lcd.print(temp);
  // lcd.clear();
   Serial.println(temp);
}
```

C. Proposed Work Coding

```
#include <Servo.h>
Servo servo_4;
void setup()
{
  pinMode(2, INPUT);
  servo_4.attach(4);
  pinMode(5, OUTPUT);
  pinMode(A1, INPUT);
  pinMode(3, OUTPUT);
}
void loop()
{
  if (digitalRead(2) > 0) {
    delay(10000); // Wait for 10000 millisecond(s)
    // wait the person reach to wash basin
    servo_4.write(90);
    delay(3000); // Wait for 3000 millisecond(s)
    servo_4.write(0);
    delay(3000); // Wait for 3000
    millisecond(s)
    analogWrite(5, 1);
    // water pump will  ON
    delay(3000); // Wait for 3000
    millisecond(s)
    analogWrite(5, 0);
    // water pump will  OFF
    delay(3000); // Wait for 3000
    millisecond(s)
    if (map(analogRead(A1), 0, 1023,0,
                        105) > 99) {
      tone (3, 523, 2000); // play tone 60 (C5 = 523 Hz)
      // Send SMS
    }
  }
}
```

D. Code for GSM module:

```
#include <SoftwareSerial.h>
SoftwareSerial mySerial(9, 10);
void setup ()
{
  mySerial.begin(9600);
 Serial.begin(9600);   (Arduino)
  delay(1000);
}
void loop()
{
  if (Serial.available()>0)
   switch(Serial.read())
  {
    case 's':
      SendMessage();
      break;
    case 'r':
      RecieveMessage();
      break;
  }
if (mySerial.available()>0)
   Serial.write(mySerial.read());
}
 void SendMessage()
{
  mySerial.println("AT+CMGF=1");
   delay (1000);  // Delay of 1000 milli seconds or 1
second
    mySerial.println("AT+CMGS=\"+91xxxxxxxxxx\"\
r"); // Replace x with mobile number
  delay (1000);
    mySerial.println("AWARE  TEMPERATURE  IS
ABOVE NORMAL ");
  delay (100);
   mySerial.println((char)26);//
  delay (1000);
}
 void RecieveMessage()
{
    mySerial.println("AT+CNMI=2,2,0,0,0");  //  AT
Command to receive a live SMS
  delay (1000);
 }
```

E. Graphical Code for Proposed Method using Tinker cad.

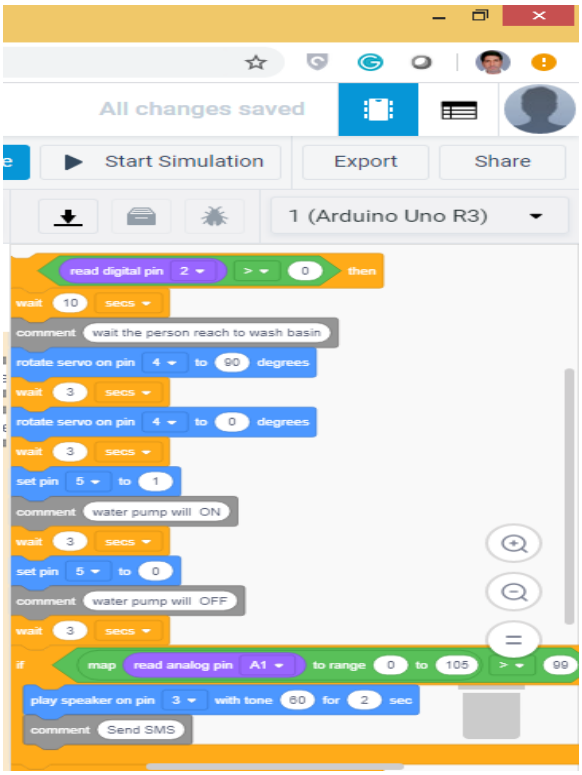
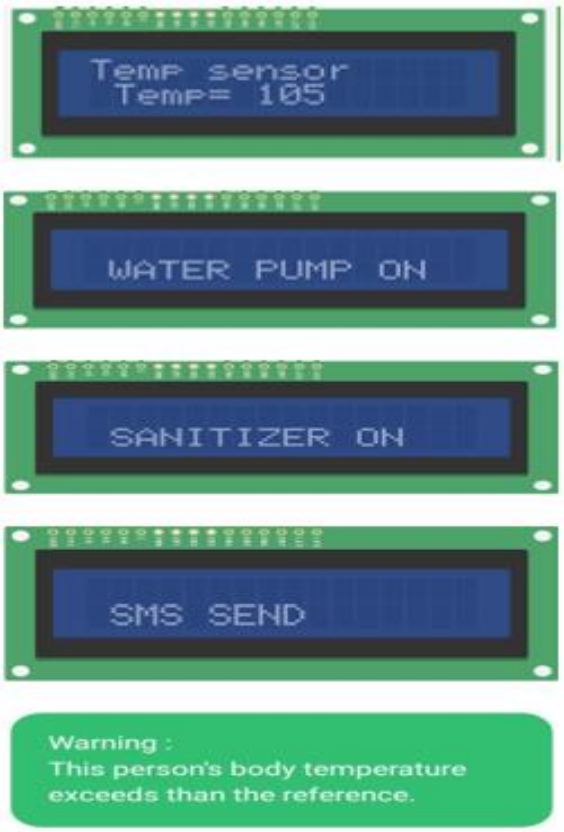


Fig:11. Proposed method graphical code

F. Experimental Result



IV. CONCLUSION

In this work a smart and economical solution for the community transmission of COVID-19 is presented. Arduino UNO processor controls two motors for water pour and sanitizing the visitors of public gathering. Also, it used the human temperature sensor to sense the visitor's temperature, if it exceeds the limit, the processor blows the alarm and also send warning SMS to the doctor using GSM module. Results shows that proposed method outperformed than existing methods in terms of delay reduction and transmission speed.

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