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SMART HOME AUTOMATION SYSTEM REPORT

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Abstract

This embedded project introduces a smart home automation system featuring temperature regulation with a fan connected to a DC motor, automated curtain control and LEDs using an LDR sensor, and a touch sensor-operated servo motor for door management. The system optimizes comfort, energy efficiency, and security in a residential setting by integrating various sensors and actuators for intelligent and responsive environmental control.

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1 INTRODUCTION

In the ever-evolving landscape of home automation, the integration of advanced technologies plays a pivotal role in transforming traditional living spaces into intelligent and responsive environments. This report delves into a cutting-edge embedded project designed to enhance the functionality of a residence through the implementation of a comprehensive smart home automation system. Focused on optimizing temperature regulation, curtain control, and door management, the project employs a range of sensors and actuators to create a seamless and intelligent living experience. This introduction provides an overview of the key components and objectives of the embedded system, setting the stage for a detailed exploration of its design, functionality, and potential applications.

1.1 OBJECTIVES

1. **Temperature Regulation:**
   - Implement a temperature sensor for monitoring indoor climate.
   - Connect a fan to a DC motor for automatic temperature adjustment.
   - Optimize energy consumption and enhance occupant comfort through intelligent temperature control.
2. **Curtain Automation:**
   - Integrate an LDR sensor to detect ambient light levels.
   - Automate curtain opening in low light and closing in sufficient light.
   - Activate LEDs when curtains are closed to provide ambient lighting.
   - Contribute to energy efficiency and privacy management based on external lighting conditions.
3. **Door Management:**
   - Utilize a touch sensor for touch-activated door control.
   - Implement a servo motor for automatic door opening when the touch sensor is activated.
   - Enhance security and convenience by automating door closure without touch sensor activation.
4. **System Integration:**
   - Ensure seamless communication between temperature, light, and touch sensors, and corresponding actuators.
   - Create a unified smart home automation system for harmonious functionality.
   - Optimize integration for a cohesive and user-friendly experience.
5. **Energy Efficiency and Sustainability:**
   - Promote energy conservation through temperature and lighting management.
   - Evaluate the impact of the automated system on overall energy consumption.
   - Design the system with energy-efficient components and algorithms for sustainability.

1.2 THEORY

The proposed smart home automation system aims to redefine residential living by incorporating advanced technology for enhanced comfort, energy efficiency, and security. Key features include intelligent temperature regulation, automated curtain control with ambient lighting, and touch-activated door management. The system prioritizes seamless integration, energy conservation, and sustainability. Overall, it seeks to provide a unified and user-friendly experience, reflecting a comprehensive approach to modernizing and optimizing the home environment.

1.3 EQUATIONS GUIDELINES

For the temperature sensor, to convert from voltage to temperature degree in Celsius we used the following equation:

Temp = ((Reading*500)/1023) – 2

-We multiplied by 500 because the LM35 readings are in millivolt voltage range.
-The subtraction of 2 because it’s the minimum value that the temperature reading.

2 Procedure and Methods

We will go through our Mikro C code with comments implemented in the code.

```
unsigned int dcntr;
 unsigned int reading;
  void Delay_ms(unsigned int k){   //ms_delay
dcntr=0;
while  (dcntr<k);
}
void Delay_us(unsigned int usCnt){        //us delay
    unsigned int us=0;
    for(us=0;us<usCnt;us++){
    asm NOP;//0.5 uS
    asm NOP;//0.5uS
  }
}

void Rotation0() {//0 Degree
    unsigned int i;
    for(i=0;i<50;i++){
       PORTB= PORTB| 0x01;
       Delay_us(800);
       PORTB =PORTB & 0xFE;
       Delay_us(19200);
       }
}

void Rotation180(){ //180 Degree
       unsigned int i;
       for(i=0;i<50;i++){
        PORTB= PORTB| 0x01;
         Delay_us(2200);
         PORTB =PORTB & 0xFE;
         Delay_us(17800);
         }
}
  void ATD_init(void){
    ADCON0 = 0x49;// ATD ON, Don't GO, CHannel 1, Fosc/16
    ADCON1 = 0xC2;// All channels Analog, 500 KHz, right justified
    TRISA = 0xFF;


}

unsigned int ATD_read(void){
  ADCON0 = ADCON0 | 0x04;// GO
  while(ADCON0 & 0x04);
  return((ADRESH<<8) | ADRESL); }

  void Rotation_2_0() {//0 Degree
    unsigned int i;
    for(i=0;i<50;i++){
       PORTE= 0x02;
       Delay_us(800);
```

```
      PORTE = 0x00;
      Delay_us(19200);
      }
}

void Rotation_2_90() //90 Degree
{
unsigned int i;
for(i=0;i<50;i++)
{
PORTE= PORTE | 0x02;
Delay_us(1500); // pulse of 1500us
PORTE =0x00;
Delay_us(18500);
}
}

void Rotation_2_180(){ //180 Degree
      unsigned int i;
      for(i=0;i<50;i++){
        PORTE= PORTE | 0x02;
        Delay_us(2200);
        PORTE=  0x00;
        Delay_us(17800);
        }
}


void main() {
           unsigned char i;
          TRISB  = 0x02; //ALL PORTB OUTPUTS EXPET RB1
          TRISC  = 0x01; //ALL PORTB OUTPUTS EXPET RC0
          TRISD=   0x00; // PORTC OUTPUTS
          TRISE=  0x01;
          PORTC = PORTC | 0xFE; //(LEDs ON)
          PORTD = PORTD & 0x00;
          PORTB = PORTB & 0x00;
          PORTE= 0x00; //ALL PORTB OUTPUTS
                ATD_init(); //180 Degree

       while(1) {

       //Temperature sensor test
           reading = ((ATD_read()*500)/1023)-2;
        if(reading>30){ //check if the reading is higher than 30
        PORTD= 0x02;
        Delay_ms(1000);
        }
        else  PORTD= 0x00;
        // Touch test
         if(PORTE & 0x01){ // check if there is a touch
            Rotation_2_0();
            Delay_ms(10);
         }
         else if (!(PORTE & 0x01)) {
          Rotation_2_90();
```

```
      Delay_ms(10);
    }

   // LDR test
  if(!(PORTC & 0x01)) {
      // If LDR detects light, turn off the LEDs
      PORTC = PORTC & 0x00; // Clear bits
       Rotation0();
       Delay_ms(10);
     }
   else {
      // If LDR does not detect light, turn on the LEDs
      PORTC = PORTC | 0xFF; // Set bits
      Rotation180();
      Delay_ms(10);

}


}       }
```

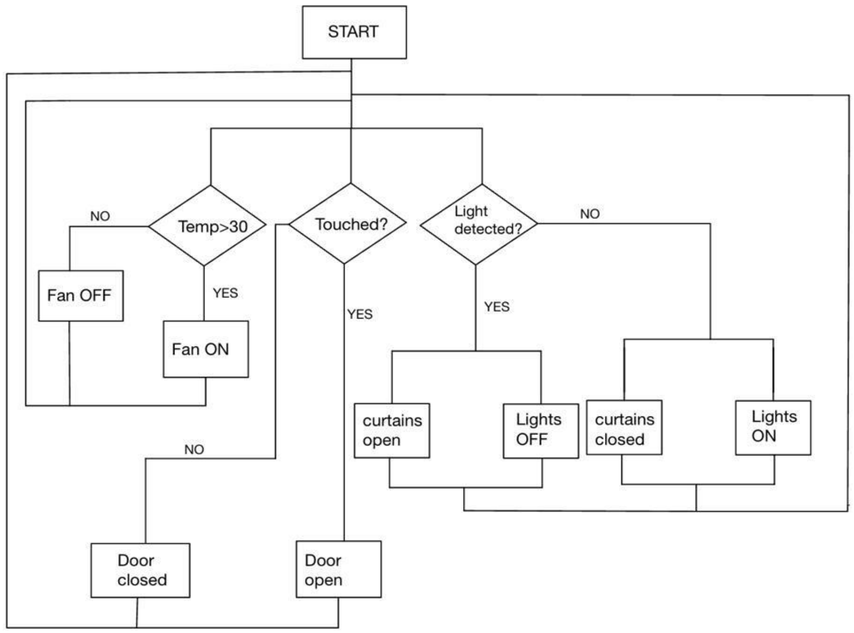
3 RESULTS AND DISCUSSIONS

The smart home automation system, implemented using a microcontroller, demonstrated successful outcomes across key functionalities. The temperature regulation system effectively controlled regulated activation and deactivation of the fan, ensuring stable and accurate temperature maintenance. Curtain automation, driven by an LDR sensor, provided customizable responses to light levels, complemented by ambient lighting when curtains were closed. Door management, facilitated by a touch sensor-operated servo motor, enhanced accessibility and security.

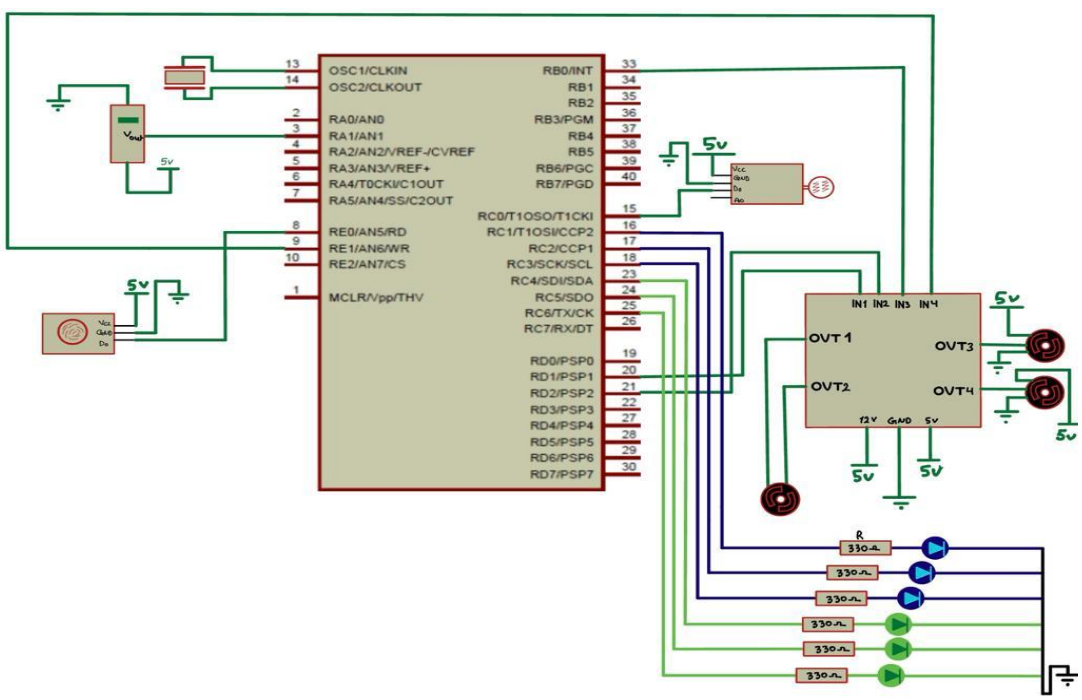
Seamless system integration was achieved, guaranteeing coordinated actions and reliable communication between sensors and actuators. The system's energy efficiency, sustainable practices, and user-friendly interface positively contributed to overall performance. Continuous user feedback informed iterative improvements, solidifying the system's potential for creating an intelligent and responsive living environment.

4 FIGURES

4.1 FLOW DIAGRAM



4.2 HARDWARE SCHEMATIC



5 CONCLUSION

Our smart home automation project, driven by a PIC 16F877A microcontroller, successfully implemented a sophisticated system for temperature regulation, curtain automation, and door management. The integration of sensors and actuators was seamless, emphasizing efficiency and sustainability. The user-friendly design and continuous refinement process position the project as a forward-looking solution, offering a glimpse into the potential of intelligent and adaptive living environments.

6 REFERENCES

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