Smart Hostel and Security System

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Abstract—United International University currently offers hostel accommodations to more than 200 students within its campus, with separate facilities for both male and female students. While the university's logistics department strives to provide the best possible amenities, there is room for improvement. These shortcomings have raised concerns about the safety of both staff and students residing in the hostels. To address these security concerns, we have conceived a project in microprocessors, microcontrollers, and interfacing. This project incorporates essential features such as a smart automated trash bin, a fire alarm system with water sprinklers, a vending machine for food tokens, automatic door opening mechanisms, and RFID-based door security. We have utilized components such as Arduino and various types of sensors in the implementation of these hardware components. One significant issue we aimed to tackle is the problem of some students consuming meals intended for others, causing difficulties for meal providers and fellow students. Our project is designed with an overarching goal of enhancing the safety and security features currently available in the UIU hostel.

Index Terms—Arduino Uno R3, Ultrasonic, RFID, Vending

I. PROJECT OVERVIEW

We're developing ourselves day by day. In everyday life, we're inventing many things that are helping ours to live our life easier. So that, all of us are trying to invent more things to make our life easier. In our Electronics Laboratory course we've a task to design project to make our everyday task easier. That's why, we've selected Hostel Management System with extended features. Nowadays, most of us are going to different city for our education. That's why, we choose hostel for living during education life. But our guardian don't feel either. Our project is to make sure the most safety to the students with real time tracking from anywhere, where guardian can see what is their children doing. Our project designed with guest mode, RFID entry with attendance, fire safety, timely food alarm, smart bin and vending machine. With RFID scan, guardian will know about their children when they're entering and exiting from hostel, that's might be a pleasure for guardian because it's important to know that what their children doing. On the other hand, fire safety features is one of the most important safety features that should be in an building. Because, in Dhaka fire problem is exceeding very fast. Everyday, many places are going in trouble for fire. As well as, our project has feature called timely food alarm. By this, students will not miss their hot meal. Parents always aware that their children is eating timely or not. So, with our smart hostel, that problem won't be faced. With automatic door open, smart bin and guest mode have made our hostel smart enough in compare with others. This will help our students to be more smart enough.

II. INTRODUCTION

More than half of the world is populated by teenage students. Among those, every year thousands and thousands of students entering colleges and universities. They have to face one of the biggest transitions in their live, that is moving into a dorm room or hostel. However, most hostels fail to provide many services that are vital for these young future builders which results in students facing many crucial problems as serious as life-threatening fires. Our hostel management system brings a solution to all these problems. It will not only provide security services by consisting of fire detector detector and water sprinkler but also comes with other advantageous and beneficial features such as Smart door services, smart dustbin and an RFID. Hence our hostel management system is just the perfect device that offers everything needed to make a student's life in a hostel much safer, Easier and better.

III. COMPONENT LIST

1) Arduino UNO R3
2) RFID
3) Servo Motor
4) Buzzer
5) RC522 Ultrasonic Sensor
6) Flame Sensor
7) Relay (5V)
8) LED
9) Battery
10) Jumper Wires
11) Water Hose Pipe

IV. FEATURE COMPONENTS

1) Feature: Smart Dustbin
   Components: Arduino UNO R3, Ultrasonic Sensor, Servo Motor, LED.

2) Feature: RFID Entry
   Component: Arduino UNO R3, RFID, Servo Motor, Push Button, LED.

3) Feature: Fire Safety
   Components: Arduino UNO R3, Flame Sensor, LED, Buzzer.

4) Feature: Water Reservoir
   Component: Arduino UNO R3, Ultrasonic Sensor,

LED, Relay, 9V Battery, Submersible Water Pump 6V

5) Feature: Vending Token Machine
   Component: Arduino UNO R3, Servo Motor, RFID, LED.

V. COMPONENT DESCRIPTION

A. Arduino Uno R3

Arduino is popular for various reasons. It is inexpensive, easy to program, open-source, reliable, and so on. After its creation, the microcontroller field has changed. From different types of Arduino boards, we've used Arduino UNO R3. It has 14 digital pins, 6 analog pins, operating voltage 3.3V and 5V, input voltage 7-20V with flash memory of 32 KB. It is a programmable circuit that can use to operate different devices with ease. CPU - Microchip AVR 8bit, memory - SRAM, clock speed - 16 MHz, weight - 25 g.
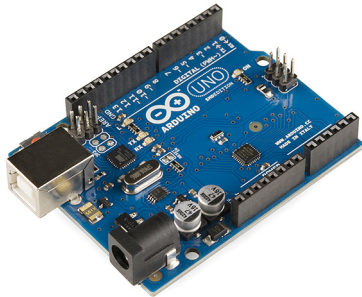

Fig. 1. Arduino Uno R3

B. RFID RC522

RFID (Radio Frequency Identification) is used to automatically detect or identify a tagged object using electromagnetic fields. Electronic information is stored on the tag or chip. It usually looks as thin as a credit card. It consists of a small electronic device with a very small chip, a coil, and an antenna.

C. Servo Motor SG90

A servo motor is a effective machine that delivers torque and velocity based on the current and voltage supplied.

D. Relay (5V)

A relay is a protective device that helps protect protective a device connected to a circuit by responding to a change in a pre-determined electrical condition in an electrical power system. Relay protects the entire system from damage when a system error occurs.
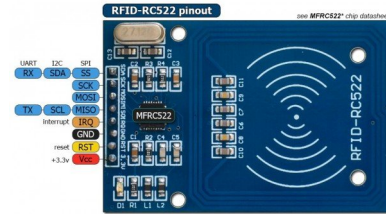

Fig. 2. RFID

Fig. 3. Servo motor

E. Submersible DC Water Pump (5V)

5V DC water pump is suitable for building- a low-cost project which costs around 50 takas. This motor can operate from 2.5   6V power supply. With an operating temperature of 80 Deg. C. its flow rate is around 120L/H. The procedure of a water pump mainly depends on a power source with proper voltage. Though it can operate at 5V but the input should be more than that. Otherwise, the motor doesn't work properly. In our project, we've used it to prevent fire.

F. Buzzer

Buzzer is a basically audio signalling device. Buzzer can be various types. We have used piezo buzzer which is a tiny speaker that can can connect with an arduino. It can generate tone at a frequency user sets. In our project, it is used as security alarm with 100ohm resister across it.

G. Flame Sensor

Flame sensors are used to monitor if there is a flame in front. It has a total of 4 pins. VCC is usually supplied with + 5v. A0 analog output. D0 digital output. GND Ground. For general observation, if you supply + 5v to the VCC pin and connect the ground, the power LED will light up. Then, if any flame is placed in front of the sensor, the D0 LED will light up and reveal the existence of the flame.

H. Ultrasonic Sensor

Ultrasonic sensor is a special sensor used to measure distances using ultrasound. Ultrasound is a kind of sound of a special wavelength. This sensor will produce a kind of ultrasound. The sound will then move forward and hit the object and return to the sensor. We will use Arduino to
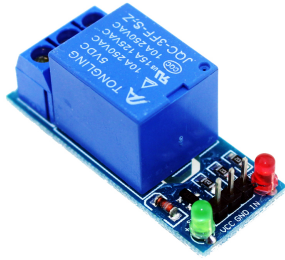
Fig. 4. Relay (5V)

Fig. 5. DC Pump (5V)

Fig. 6. Buzzer

Fig. 7. Flame Sensor

calculate the time elapsed between word creation and retrieval.

VI. Implementation

A. Flow Chart

1) Smart Dustbin: As the first feature we have a smart automatic dustbin,we have components such as Arduino UNO R3,RC522 Ultrasonic sensor and a servo motor.We attached the RC522 ultrasonic sensor in front of the dustbin and connected it to the Arduino pins.We also used a servo motor on the top of the dustbin.When an object or some form of garbage is about to be thrown into the garbage can and taken in front of the garbage can the ultrasonic sensors can detect the object as per coded the Arduino allows the top to come off so that the garbage object can go in.

2) RFID Entry: The RFID entry checker allows entry safety and security for the students of the hostel.The students have to show their university ID which has been used as the RFID card here to checker and the RFID takes the information from the card and if the information matches any student data it allows the student to enter if he wishes to enter.To complete this feature we have used a Arduino UNO R3 to be connected to the RFID Scanner. Here is a catch that if anyone would like to entry in odd time then it would be able to get into the hostel with RFID scan. He needed to inform the hostel supervisor. Hostel supervisor will come in front of the scanner and student will give explanation about why he became late. Another option is guest mode. A guest switch will be added. If any guest entries he needs to inform hostel supervisor.

3) Fire Safety: This flame sensor module has IR receiver attached to it. In case of fire a small amount of ire light that is infrared light is emitted. Sensor detects this iron light an output signal accordingly. It has three control pins VCC, Ground and DO. The DO point gives digital output from sensor that is 0/1. If it detects fire then output is low that is 0V and if there is no fire output is high that is 5V. this model has built in potentiometer for sensitivity adjustment of DO signal. A threshold can be set by using potentiometer. If we turn it clockwise then sensitivity increases if we turn it counterclockwise then sensitivity decreases. This module has two power LED. The power LED will light up when module is powered on and the status LED will light up when the flame is detected (that is when digital output goes low).

4) Water Reservoir: When water level decreases in certain level the water pump will automatic on. The system is effective and reduces the concern of getting checked the water level again and again.

5) Vending Token Machine: Students suffer much with food like sometimes one eats another student's meal. To prevent the suffering, we've developed a vending machine that will take the student id scanning and give 3 tokens based on breakfast, lunch and dinner. With the token student can have their meal in time. Each day one student can have 3 tokens. When second time the token scanned within 24 house, there will be shown red light. Next day, student can get their token again.

VII. Project

An Arduino Mega, an Arduino UNO R3 have been used in the project. The diagram 01 is the diagram of the feature 2

Fig. 8. Ultrasonic Sensor
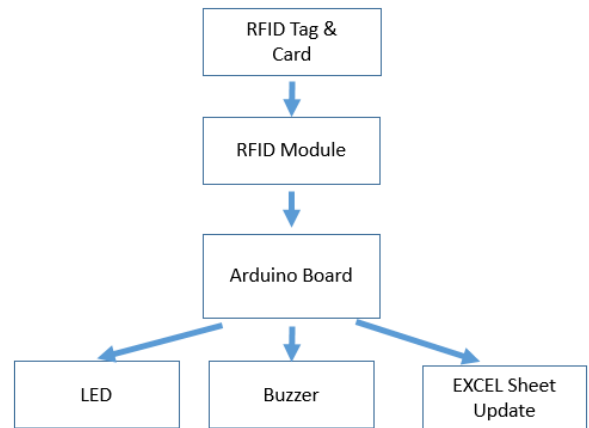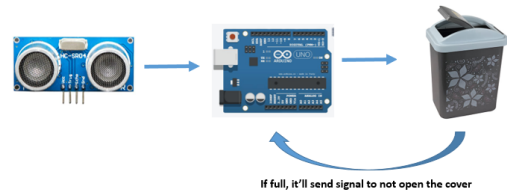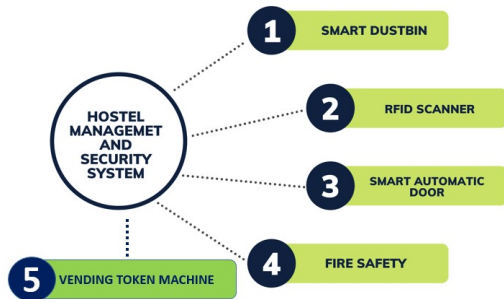
and 3, the diagram 02 is feature 1,4 and 5.

VIII. FUTURE PLAN

While implementing our project, we've found some difficulties with GSM module and guest mode. For that reason, at the end of the moment we dropped the concept to send notification to parents. Our priority would be, we should definitely build the system with GSM. In extend, we would collaborate the system with application to get instant update.

IX. IMPORTANT LINKS

Project Video: (https://drive.google.com/drive/folders/1gUuVCtxiwD6YpKegniWMBapWJBgTrdlj?usp=sharing)

Codes: (https://github.com/sajedulislamsajib/Smart_Hostel_and_Security)

X. CONCLUSION

Our project is designed to ensure safety as well as management to help the authority. Students' guardian will be happy to take the result as granted by knowing that their children is in safe-secure place. We hope our project result would be completed as our expectation.
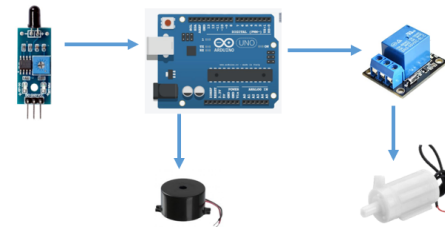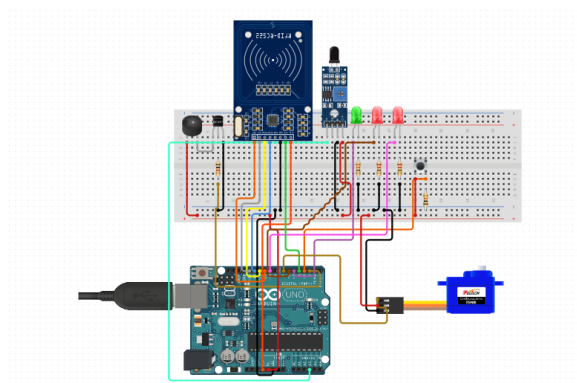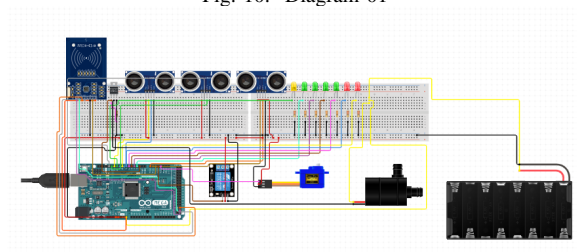

Fig. 9. Project

Fig. 10. Diagram 01

Fig. 11. Diagram 02