

Design and implementation of secure system to protect a very important place

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Abstract– Nowadays, there is a need to secure many important places such as gas stations, power stations, hospitals, banks, schools or even our homes. From this standpoint, the goal of this project is to use modern technology such as smart technology and the Internet of things to secure important places.

The project works to secure the entrance, the gate and the garage. In addition to the road safety system is used. In this system, when the speed of a car exceeds a certain limit, a ground mechanism open and stop this car. Also, the project includes a fire and gas leakage insurance system, a ventilation and heat control system, and another system for controlling soil irrigation. All of the above is executed with the help of smart devices such as security alarms, sensors, etc. and are coordinated by Arduino microcontroller.

The place is monitored and controlled remotely via an application on the mobile device using Internet of Things technology where a wireless IP camera is used. In addition, a solar power source is used as a backup system.

Keywords— Smart technology; IOT; Securing important places

I. INTRODUCTION

Egypt seeks to achieve its vision 2030[1] for sustainable development, which aims at Egyptian security as well as using innovation and scientific research to achieve sustainable development. So, the security of people and facilities and important places is the main motive for this project.

New technologies help in this field such as smart technology. Smart technology have made meaningful improvements to the quality of life and services to people. It is capable of controlling physical objects in real time and delivering intelligent information to users in terms of , smart buildings, public safety, smart parking, and traffic system and smart agriculture, and so on [2]. The integration of various cheap smart devices like sensors and the rapid development of wireless communication technologies. The rapid development of wireless communication technologies such as IOT [3] has led to the increase in the deployment of small and inexpensive devices that can connect to the internet where physical devices are changing to smart devices in our life.

In this project we use smart technology and IOT wireless connection to protect very important places. The system contains many features such as, securing the entrance,

the gate and the garage, protecting the road from any car attack,

a fire and gas leakage insurance system, controlling ventilation temperature and controlling soil irrigation.

In addition, a backup source using solar energy as a renewable and clean energy. The model of this system provides safety and security of important places, reduces the human interaction to make basic daily decisions, uses a sustainable power source (solar) and reduces the usage of power and provides a smart irrigation to face the clean water problems.

The remaining of the paper as follow: section II describes the design of the system. Section III shows the project model approach. Section IV indicated the software design. Section V shows the experimental results and finally, section VI is conclusion.

II. THE DESIGN OF THE SYSTEM

A. The Proposed Model

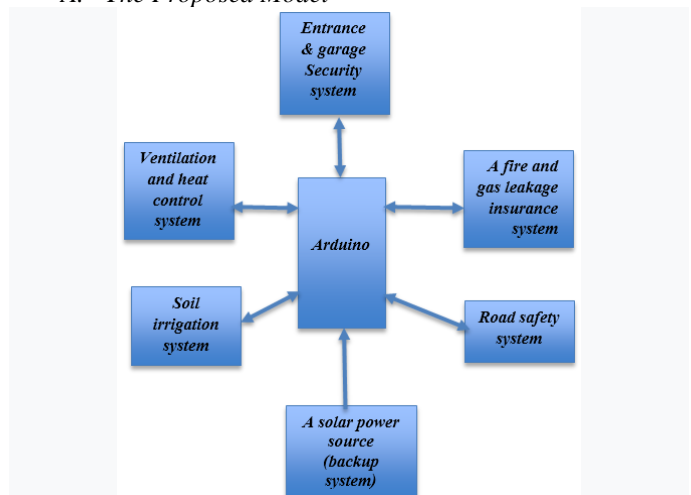


Fig. 1 Block diagram of the system.

The block diagram of the proposed Fig. 1. The Model contains five subsystems: the entrance and garage security system, the road safety system, a fire and gas leakage insurance system, a ventilation and heat control system, and finally soil irrigation system.



these subsystems are controlled by Arduino. The microcontroller collects the data of all sensors take decision according the reading of sensors. The system connect wirelessly using ESP32CAM module, where it has wireless communication capabilities and its WIFI antenna. Once the user connects to the IP address of module, the place is controlled remotely by mobile of user .Also the reading of the sensors and the captured images sends to the user mobile. In addition a backup source which are the solar panels that provide source of power in case of electricity is off.

III. PROJECT MODEL APPROACH

The structure of the prototype is designed on AutoCAD program. Fig. 2a shows the prototype of the structure while Fig. 2b shows the real model.

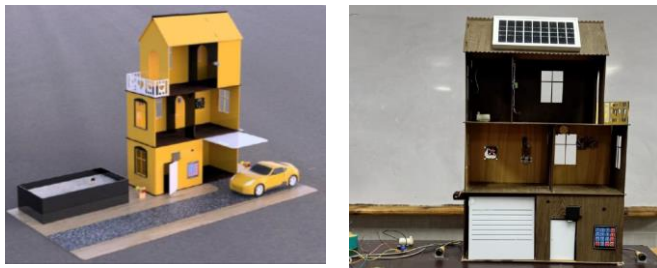


Fig. 2 (a) The prototype

Fig. 2 (b) The real model

A. Hardware Components of the Project

1. Arduino Nano [4]
2. ESP32CAM module[5]
3. Water pump
4. Buzzer
5. Keypad
6. Fan
7. solar cells
8. Batteries DP-18650, 1500mA, 3.7V, Li-ion, rechargeable
9. DC converter
10. Servo motor
11. Soil moisture sensor.
12. MQ-2 sensor (detect smoking)
13. Flame sensor
14. DHT-11 sensor for temperature
15. Proximity sensor

B. Entrance and garage security system

When someone comes to enter the main entrance Fig. 3a, or the garage door Fig. 3b, he should put the password on the keypad. If it is correct, the door will open and if it is incorrect, the buzzer will be turned ON to alert people in the building that someone try to break into the building. Also, the camera of ESP32CAM captures the images of the person who is in the entrance and the WIFI connection is set up. Then the captured images are sent to the user mobile to know who this person is.

Fig. 3 (a) The main entrance

Fig. 3 (b) The garage door

C. Road safety system

As shown in Fig. 4, the road safety system, if the speed of the car exceeds a certain limit that is predefined, a ground mechanism will be opened and stop this car Fig. 5a. By using this system, it is possible to protect the place from a terrorist attack.

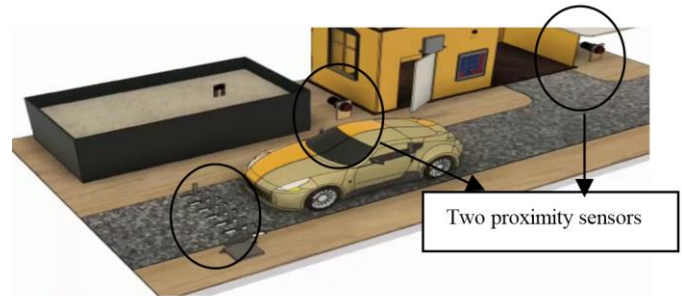


Fig. 4 The road safety system

To determine the speed of any car, two proximity sensors are used Fig. 5b. They are fixed on the road and are separated at fixed distance. According the difference time between triggering the two proximity sensors speed is calculate as the fixed distance divided by the difference time. A servo motor is used to open and close the mechanism Fig. 5a.



Fig. 5 (a) Ground mechanism

Fig. 5 (b) Two proximity sensors

D. Fire and gas leakage insurance system

To detect the fire, a flame sensor is used. If the flame is detected a buzzer will turn on and the pump of water will be tuned on to put off the fire. Fig. 6 shows the fire detecting system and the water pump.



Fig. 6 Fire detecting system and the water pump

A Gas sensor MQ-2 is used to detect carbon mono-oxide in air, when the carbon mono-oxide exceeds limit the buzzer alert and red light is turned on. Otherwise, when carbon mono-oxide is less than limit green light turned on. Fig. 6 shows the gas leakage insurance system.

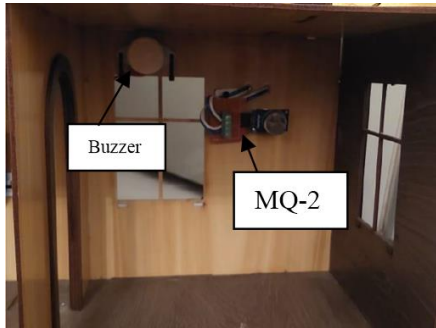


Fig. 7 The gas leakage insurance system

E. Ventilation and temperature system control system

In Fig. 8, a humidity and temperature sensor is used to detect temperature in room. When temperature exceeds certain limit, the fan will turn on.

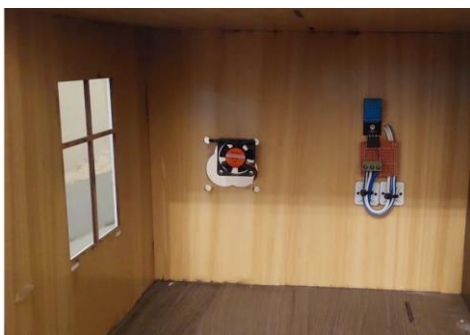


Fig. 8 The ventilation and temperature system control system

F. Soil irrigation system

One of the ways to save energy and water is to use a sensor to determine soil moisture to know the condition of the soil. If it is dry or wet through certain measurements through which the condition of the soil is determined. Fig. 9 shows the soil moisture sensor and the water pump.

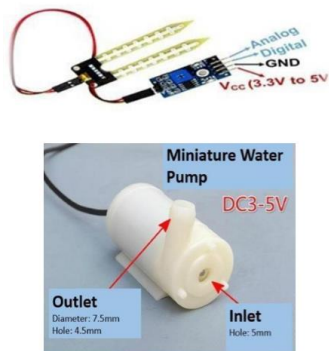


Fig. 9 soil moisture sensor and the water pump.

G. Backup source

Solar batteries are able to store extra solar energy so you can use it later on. This lets you power your place or your building on a clean renewable energy from your solar panels. Installing a solar battery allows you to be less reliant on the electric grid while ensuring you have access to reliable backup power when there's a power outage.

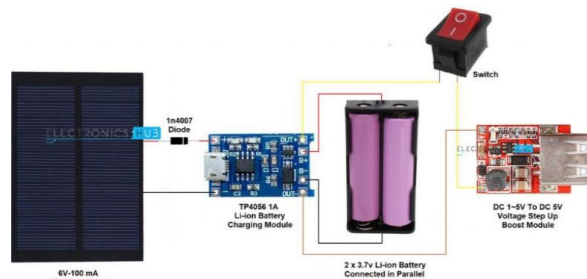


Fig. 10 Backup source system.

IV. SOFTWARE IMPLEMENTATION

The Arduino Software runs in an environment called IDE. This means that you will either need to download the desktop IDE to code in or code online on the online IDE. Next you will write code for a program that you want the Arduino board to run.

Fig. 11 shows the flow chart of the program. After initialize all the devices of the system and WI-FI connection is established, all parameters of sensors and keypad is read. According the condition of each parameter the system takes the suitable action.

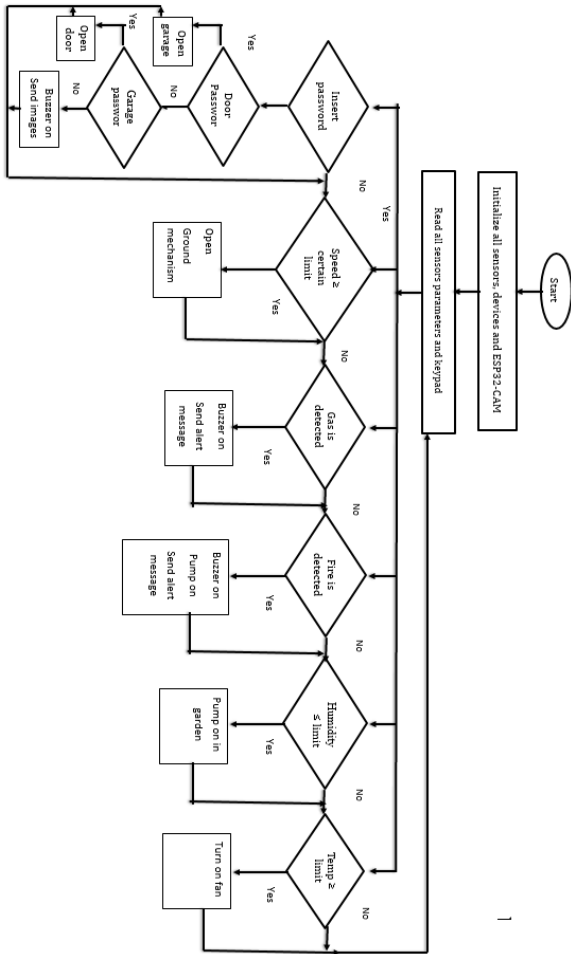


Fig. 11 Flow chart of software.

V. RESULTS

The experimental results are shown in Fig.11 and Fig. 12. In fig. 11, there are warning messages about a fire and some try to enter the place that are received on mobile user. Fig. 11b illustrates the image of the person that is on the gate and enter incorrect password. Fig. 12 a shows the reading values of temperature and humidity as the user request their values.

In Fig.12 b, it is indicted how to open or close the fan manually, from the mobile of user.

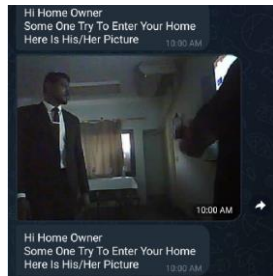


Fig. 11(a) alarm of fire

Fig. 11(b) captured image and alarm of attack



Fig. 12(a) reading the tempture and humiditiy

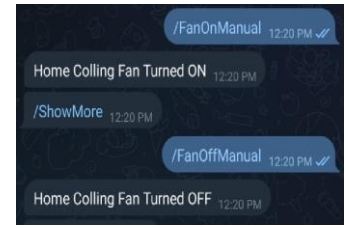


Fig. 12(b) turn on and off fan manual

VI. CONCLUSION

In this project, a secure system is designed and implemented to protect important places .the system has many subsystems such as the entrance and garage security system, the road safety system, a fire and gas leakage insurance system, a ventilation and temperature control system, and soil irrigation system. This model has many advantages where. Provides safety and security to the important place, Reduces terrorism by safety securing system in road, reduces the human interaction to make basic daily decisions, and uses smart irrigation to face the clean water problems.

A backup power source is used where the solar energy is used as clean resources of power. Solar energy is a clean renewable energy save our environment.

This prototype is an engineering model that can be developed and applied to many important places such as power gas stations, schools, hospital, banks, factories and tourist village.

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