IoT Based Home Automation System Using Android Application

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Abstract — the importance of home security has increased because the Internet of Things (IoT) devices are used more frequently in home automation. The possibilities to design and use a wide range of features for an IoT-based security system are endless, despite the fact that the field of smart home security systems has seen several major advancements over the previous years. Our proposed project introduces a low-cost Internet of Things-based home automation and security system that gives the user full remote control over the home applications. Our Android application interprets the data acquired from sensors like DHT11, MQ2, Fire sensor, Ultrasonic sensor, and PIR sensor using Google's Firebase. For intruder detection, the security system includes a PIR sensor and a camera module, and it immediately notifies the user via an online alert notification all owing to our OpenCV-based smart burglar detection system created using python. Our proposed model is entirely an IoT system that provides live notification alerts and protection from intruders by utilizing the real-time database of Google Firebase. Furthermore, to keep future evidence and also to avoid false detection, we have included a camera module that tethers real-time video to the user over the internet. This system provides features similar to many industry-grade smart home security packages by utilizing local hardware components; hence reducing the overall implementation cost.

Keywords — IoT, Kodular App Creator, NodeMCU, Firebase, Sensors, Wifi.

I. INTRODUCTION

Security has always been a concern in our homes, offices, stores, etc., and it continues to be so today. The need for a security system is critical due to the rise in crime and break-ins. The Internet of Things (IoT) technology has emerged as a major innovation in this aspect throughout the last two decades. With embedded software and sensors, this network of appliances is expanding quickly, and there is an increasing need for real-time control so that users can conveniently make decisions about their appliances, manage their systems remotely, and ensure a higher level of security. It is necessary to have a security system that continuously scans the region and responds quickly to the threats. For both indoor and outdoor applications, there are several security systems in the market, including ultrasonic detectors, CCTV, infrared detectors, etc. However, each system has its own drawbacks, such as high cost, higher power consumption, higher recording system memory space utilization, complicated circuitry, etc. Utilizing a low-cost sensor with the capability to detect trespassers as they enter the sensor's detection range and produce an output may be a way to solve these issues.

In this project, we propose to make an IoT Based Home Automation App using Kodular.io and Google Firebase. Our android application uses a real-time database (Google Firebase) for storing and rendering the sensor's data. Google Firebase is a Google-backed app development software used for creating, managing, and modifying data generated from any android/IOS application, web

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services, IoT sensors & Hardware. Next is Kodular, which provides the best way to make apps with a simple interface and code, there are many components and options, and also the material design. So, we have designed a home automation Android Application using Kodular.io. using the Firebase Host. Whenever we turn ON/OFF the switches from the Application the changes will be updated in the Firebase database. In order to know our topic better and the research already been done, we have referred to the following research papers:

[1] IoT-Based Home Automation using PIR Motion Sensor and NodeMCU

The authors of this paper are Ranjithkumar. R, Rathish Ganesh. S, Ram Vikash. K, and Maniknandan. M. The main objective of this project is to conserve electricity by switching off the appliances/devices when no physical motion is detected. As a PIR sensor is used, it will work within a definite range only. Ultrasonic sensors (HC-SR04) could be used with this prototype; thus, the precision of human motion detection could be improved.

[2] Fingerprint-Based Door Access System using Arduino

This paper belongs to authors Malabika Sarma, Amalanjyoti Gogoi, Rahul Saikia, and Dibya Jyoti Bora. To solve the security issues, implementing a door lock by the concept of biometrics and servo motor is the methodology followed by the project. As this system doesn't use traditional locks, losing keys will not be a problem.

[3] Smartphone Controlled Fingerprint Door Lock (SCFDLS)

Smartphone Controlled Fingerprint Door Lock (SCFDLS) is written by Ponmalar A, Anand J, Dharshini S, Aishwarya K, Mahalakshmi S, and Abinaya S. The proposed system uses a solenoid lock to make a door lock. A mobile app is used to inspect and double-check the finger impression and send the confirmation through Bluetooth. An android utility is established on smart devices, and credentials are used for the same.

II. METHODOLOGY/EXPERIMENTAL

A. Components:

1. Kodular App Creator:

Kodular allows you to create android apps with a blocks-type editor. Kodular provides various modules to create apps and its components without the need of coding.

Kodular was used for creating the app to receive real-time data from the sensors of the system and to notify the user in case of rare, damaging events.

2. Python- OpenCV:

Open-CV is a library in python which is designed for solving computer vision problems. It is also used in machine learning and image processing. By this images and videos can be processed to identify faces, objects etc.

Open-CV python library's image processing part was used with a camera for identifying intruders who trespass.

3. Google-Firebase:

Firebase is also an app development software enabling developers to develop apps, it also provides the developers various tools enabling them to track analytics, report and fix app crashes. It also has authentication and real time cloud database services which were used in our proposed system. Data from different sensors is stored in a cloud database which also makes the system more cost-effective.

4. NodeMCU:

NodeMCU is an IoT platform based on ESP8266 sensor using wifi-protocol. It can connect objects enabling them to transfer data using wifi. In this system it will take data from sensors and will share the data with firebase for cloud storage.

5. Sensor:

We have added various sensors to our project which includes DHT11, MQ2, Fire sensor, Ultrasonic sensor and PIR sensor (Passive Infrared sensor) for the user to be aware of all the different parameters of his house and get real time alerts

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with the Gas (MQ2), fire and PIR sensors. These sensors are connected to NodeMcu which is further connected to the Firebase for cloud storage acting as a database as a database for the system.

6. Camera:

Camera is used for monitoring as well as image processing. It will be used for surveillance

B. Flowchart:

III. RESULTS AND DISCUSSIONS

Not only does our app feature home automation, but it also ensures the utmost security of the user through real-time alerts and notifications upon detection of danger or suspicious activities.

Fig. 1. App Screen 1 (Home page)

Our app's first screen features a greeting page. It displays our group logo and a home automation logo. Our app can be used in two modes: Light mode and Dark mode. The dark mode is very popular these days which also saves the battery of your phone and is eye-friendly.

Fig. 2. App Screen 2 (User verification page)

Our second page is the "User Verification" page. To ensure the utmost security of the user's data and house appliance control, we have used a fingerprint sensor, which first verifies the user and then allows him/her to use the app further. The major drawback of various home automation apps in the market today is that they do not ensure security for the user's data. We have decided to overcome this using the inbuilt fingerprint sensor of a mobile phone. Also, in the text box, we need to paste the unique IP address generated by the NodeMCU which is visible in the serial monitor of the Arduino IDE.

Fig. 3. App Screen 3 (Sensor's data display page)

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The third screen of our app projects the readings of different sensors installed in the home automation system. The readings of the temperature and humidity sensor (DHT11), ultrasonic sensor, gas sensor, PIR sensor, and Fire sensor gets updated every now and then to make sure the user gets real-time notifications and alerts. In case of gas leakage, If the gas sensor readings exceed a certain threshold, an alert pops up on the screen to notify the user to turn off the gas stove. Also, in case of a fire breakout, the user gets an alert thereby avoiding danger.

There are toggle switches for the user to switch between on and off states while turning the home appliances on and off.

Fig. 4. App Screen 4 (Live camera stream page)

The fourth screen displays a live stream of your IP Camera which you can turn on in case our smart burglar detection system detects any suspicious activity around your home.

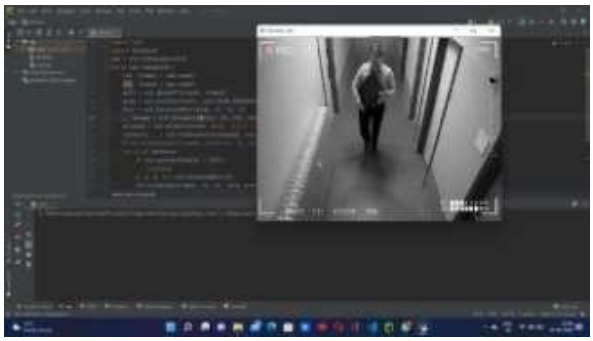

Fig. 5. Python burglar detection system

Our Burglar detection system finds out threats and triggers the buzzer on detecting suspicious activity so that the user can check the live feed of the camera using our app.

IV. FUTURE SCOPE

Due to huge upgrades in the field of automation technologies, home automation techniques have now been used widely. As we have used various sensors including a fingerprint sensor, PIR motion sensor as well as a camera which improves the security of the home, thus it is very useful concerning future perspective. We can implement several tasks with just a single command of instructions. These technologies can be used to build home automation systems, and also for sensing different phenomena such as temperature, water level, humidity, etc. It would also provide security and alertness with the help of a fingerprint sensor, PIR sensor, and camera. The devices work automatically and hence, there is no wastage of time and energy. It will also help in enhancing the quality of life of the users by improving efficiency.

CONCLUSION

Our project most importantly brings more ease and comfort to human life by making it automatic. It also helps us in the aspects of security, also creating a secure environment by notifying us everything about the threats and suspicious activities on our mobile phones through our app.

VI. ACKNOWLEDGMENT

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