Smart City

An IoT (Internet of Things) smart city uses technology to connect everyday devices, like streetlights, traffic signals, and sensors, to the internet. This connectivity allows the city to collect and analyze data to improve efficiency and quality of life for its residents. For example, smart traffic lights can adjust in real-time to ease congestion, while sensors can monitor air quality and water usage to ensure a healthier environment. The importance of IoT smart cities lies in their ability to make urban areas more sustainable, safe, and convenient by reducing resource waste, improving public services, and enhancing overall city management. This can lead to a better quality of life for everyone living in the city. Here is an overview of what we have built.

Moreover, IoT technologies can enhance public safety by providing real-time monitoring and emergency response systems, such as smart cameras and sensors that can detect incidents and alert authorities immediately. They also support energy efficiency through smart grids and lighting systems that adjust to actual usage patterns, saving costs and reducing environmental impact. By integrating these advanced systems, smart cities create a more livable and adaptable urban environment, where technology works seamlessly to support the well-being and convenience of its inhabitants.

NOTE: *If You have any question, you can contact us on the following two emails.*

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Buildings we have showcased

Note: To see the image of each building separately, please visit the image library of the project here.

Hospital

- Hospital contains 2 buildings; Hospital-2 building contains an automatic lift on the back side. It detects the Person using an IR sensor and after a certain delay it starts automatically. When it reaches the top, it stays there for a specific delay and then moves down again.
- It also contains a smart CT scanner which works on a DC motor when powered. TODO: We powered it directly by a lithium cell; you can use a relay switch and connect this relay to any microcontroller you like to automate this process.
- There was an LDR on the backside of Hospital-1 building which turned on some LED lights inside the hospital, when it was nighttime.
- Normally, when we give a drip to a patient, a nurse takes care of it and waits for it to finish but we have ended this thing by using water level sensors. There will be a water level sensor inside the drip which will trigger an alarm when the drip becomes empty. For the alarm system, we have used an LED, you can use even a buzzer or other equipment. So, in our project when the drip becomes empty, its LED will turn on. Obviously that LED will be placed near the doctor. For one drip on a certain bed, there will be one corresponding LED near the doctor. For 100 beds, there will be 100 LEDs. Remember! LED will represent that a drip on this bed is now empty. See how tech is replacing some dumb jobs? Read an article written by one of our team members, Muneeb, where he discusses the future of tech and metaverse technology. Read it here.
- There was also an Automatic door which opens when a person approaches it. We detect the person by an IR sensor.
- At last, there were mobile-controlled lights. We used Blynk IoT platform to develop a mobile app for this.

Main Conditions:

Feature	If input is HIGH	If input is LOW	Equipment's Used
Night Lights	LEDs will Turn On	LEDs will turn off	LDR and LEDs
Automatic Doors	Open the door	Closes the door	Servo, Infrared proximity sensor
Wi-Fi LEDs	Turn On the LEDs	Turn Of the LEDs	Blynk IoT, LEDs
CT-Scan	CT-Scan will rotate	CT-Scan will stop	DC Motor
Lift	Moves the Lift to First Floor	Lift will stay at the Ground floor	DC Motor, Infrared proximity sensor, LED, Strings
Drip Alarm System	Turn the corresponding Drip LED light ON	Turn the corresponding Drip LED Light off	LED, Robodo SEN18

Others equipment used:

NAME	NUMBER
ARDUINO	2
NODEMCU	1
BREADBOARD STRIP	1

Smart College

- It was the biggest module of the whole project. It contains many smart features. Let's start with the Attendance app.
- In attendance which was built using 3rd party python libraries. We used simple facial recognition algorithms to detect the faces of students and teachers. Firstly, teachers mark their attendance at the reception. Then attendance of the students is marked by a camera which is attached in the classroom. It captures an image and then using image processing libraries we detect the faces, mark their attendance, and then save it in a CSV file.
- Now we have used the laptop camera for attendance purposes. You can buy other camera modules, and you can connect it with a Wi-Fi supported microcontroller which can mark attendance remotely without the need of saving a CSV file because it will need a storage device. You can create a web app and then using it you can mark attendance by using simply GET and POST requests. But remember it was not in this project.
- There were 2 automatic doors installed as a prototype for other doors. These doors use servo motors and can be controlled by a mobile app. Mobile app is again built using the Blynk IoT platform.
- There was a flood detection system installed on the ground floor. We are also collecting the temperature and humidity of the building.
- Then we used a buzzer as an emergency alarm, also there was a fire detection system and air monitoring system as well. Both systems have the ability to trigger an alarm if their readings cross a certain threshold defined in the programming.
- In mobile app, we can control LEDs and Doors. We have used like 12 small LEDs and 1 big LED in reception.

Main Conditions:

Feature	If input is HIGH	If input is LOW	Equipment's Used
Alarm System	Turn the Buzzer ON	Turn the Buzzer OFF	Buzzer
Exhaust System	Turn the Fans ON	Turn the Fans OFF	12v Fans x2
Air Quality	Exhaust System will turn ON and turn buzzer ON	Fans will remain OFF	Exhaust System, MQ-135, Alarm System
Automatic Doors	Open the door	Closes the door	Servo, Infrared proximity sensor
Wi-Fi LEDs	Turn On the LEDs	Turn Of the LEDs	Blynk IoT, LEDs
Temperature Monitoring	Turn the Alarm System ON, and Exhaust System ON	Do nothing	Exhaust System, DHT11, Alarm System
Humidity Monitoring	Turn the Alarm System ON, and Exhaust System ON	Do nothing	Exhaust System, DHT11, Alarm System
Attendance App	Mark the Attendance and save it in CSV file	Wait for someone to mark attendance	Python

Flood Detection	Turn the Alarm system ON	Do nothing	Robodo SEN18, Alarm System

Others equipment used:

NAME	NUMBER
ARDUINO	1
NODEMCU	1
4 CHANNEL RELAY MODULE	1
BREADBOARD STRIP	2

Smart Home

- Smart Home is simple and straight forward. Firstly, the LEDs can be controlled by a mobile app. But in this case, the mobile app is a little bit advanced as it will also give updates about temperature and alarm system.
- App will also send a notification if air quality sensor installed in the house crosses a threshold.
- We can also control the fans installed in the house with the mobile app.
- There was also a rain detection system installed in the home.
- For emergency alarm, we send a notification to your mobile where Blynk will be installed. We have also installed a buzzer.
- Another feature is that if air quality level in the house crosses the threshold, an exhaust fan will be turned on automatically.
- And when you want to enter the home, you must use your RFID. When you scan it, the door will open automatically.

- For the garage door, you can use the mobile app to open it.

Main Conditions:

Feature	If input is HIGH	If input is LOW	Equipment's Used
Alarm System	Turn Buzzer On	Turn buzzer off	Buzzer
Air Quality	Turn Alarm System ON, and send notification to mobile	Turn Alarm system off	Alarm System, MQ-135, Blynk IoT
Wi-Fi LEDs	Turn On the LEDs	Turn Of the LEDs	Blynk IoT, LEDs
Rain Detection	Turn the Servo motor to cover roof	Turn the Servo such that roof will be open	Servo motor, Plastic sheet, Rain sensor
Smart Fan, mobile controlled	Turn on the Fan	Turn of the Fan	Blynk IoT, 12v Fan x2
Garage Door automation	Open the Garage gate	Close the Garage gate	Blynk IoT
Main Gate automation	Turn the Door On by scanning your RFID	Door will remain locked	RFID

Others equipment used:

NAME	NUMBER
ARDUINO	1
NODEMCU	1
4 CHANNEL RELAY MODULE	1

Smart Mosque

- Smart Mosque contains a speaker installed with a microcontroller.
- When the time for Salah comes, Microcontroller will send a signal to the speaker to give Adhan automatically without the need of Moazin.
- This feature is controversial and needs permission from a scholar to implement it.

Main Conditions:

Feature	If input is HIGH	If input is LOW	Equipment's Used
Automatic Adhan	Give the Adhan when its prayer time	Wait for next prayer time	Sound system

Others equipment used:

NAME	NUMBER
ARDUINO	1
AMPLIFIER MODULE	1
SPEAKER	1
MP3 MODULE	1

Smart Parking

- In a parking lot there was a barrier which was attached to a servo motor.
- Whenever a car is detected by an IR sensor it automatically opens the barrier for the car.
- Behind the scenes, the algorithm will be updated to show that 1 car has entered the parking lots.
- When the car has to leave, another IR sensor detects the car leaving and updates the algorithm that one car has left the parking lot.
- Another feature of parking is that we also have an LED attached on the entry point which gives a signal to the driver that a lot in the parking lot is empty or not. If there is a space for another car, the LED will be green, and barrier will open for cars. But if the parking lot is filled, the LED will be red, and barrier will never open until a car leaves the parking lot.

Main Conditions:

Feature	If input is HIGH	If input is LOW	Equipment's Used
Smart Entry	Open the barrier if any 1 parking lot is empty	Wait for the car	Servo Motor, IR sensor
Smart Exit	Open the barrier	Wait for the car	Servo Motor, IR sensor
Smart LED	Green if Parking is Available	Red if Parking is not available	RGB Light

Others equipment used:

NAME	NUMBER
ARDUINO	1

Commercial Building

- In the commercial building there was nothing special.
- We just installed a few LEDs in there and powered them to light up the building as it was looking very good with the set.

Main Conditions:

Feature	If input is HIGH	If input is LOW	Equipment's Used

LED	Turn The LEDs ON	Turn the LEDs of	LEDs

Street Lights

- We used an LDR to detect the intensity of light.
- If the intensity of light falls below the defined threshold i.e. it is evening time, then the streetlights will be turned on automatically.
- In morning, if microcontroller detects LDR reading crossing a certain threshold, then streetlights will be turned off automatically.

Main Conditions:

Feature	If input is HIGH	If input is LOW	Equipment's Used
Night Detection	Turn The Street lights ON	Turn the Streetlights off	Streetlights, LDR

Others equipment used:

NAME	NUMBER
ARDUINO	1

Clock Tower

- In the clock tower there was just a clock that tells gives the time.

Others equipment used:

NAME	NUMBER
CLOCK	1

Smart Park

- In the bench there were charging ports installed which can be used for charging purposes.
- These ports and switches are powered by Solar energy.

Others equipment used:

NAME	NUMBER
SOLAR PANELS	2

Some Important Links

- Visit Our Image Gallery: Click Here or visit (https://mega.nz/folder/9NQFnLRA#2EGFezg7hKZYjzW8xVjetA)
- See the Code Used for the Project on the GitHub: Click Here or visit (https://github.com/MuneEbxPKPK/Smart-City)

About Us

- The project was designed for a display at PGC National Robotics Exhibition 2024 held at Lahore, Pakistan in the main Muslim Town Campus.
- We were a 13-member team along with 2 professors from the PGC institution.
- Remember that if you have any query about the project, feel free to contact us on the 2 emails given above.

Credits:

- Special Thanks to Rehan and Muneeb for completing the programming and wiring part of the project.
- Thanks to our mentors Professor Tahir Iqbal, and Professor Hamza Niaz

Designed By: Muneeb Ul Karim