Implementation of a Smart City using IOT protocols

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1. Goal Of The Project

To implement a smart city using IOT and solve daily life problems in a city and reducing human effort.I have focussed on 7 major problems in a city.

2. An Overview of Smart City.

A **smart city** is one that has digital technology embedded across all city functions.A Smart City equipped with basic infrastructure to give a decent quality of life and clean and livable environment to live smarter.

The Smart City includes government services, transport, traffic management, energy, health care, water and waste.The smart city applications are major goal of improving the management and transforming the urban areas. The major technological, economic and environmental changes have generated interest in smart cities.

The next step in the evolution of human lives is the development of Smart City. It will make our daily life more disciplined and functional in a healthy manner. It will save resources and make our tasks more technological oriented. We would be able to experience this change from our household to daily work. In our home and public sector we can implement a clean environment using digital waste management technique. Smart City using IoT will bring a major lifestyle change and adaptability for the humans to live in advanced future.

We have implemented several features of a smart city as described below:

1. Automatic Toll Tax system

- We are implementing an automatic toll tax system which will scan your RFID card and display your information in the screen for a faster digitized process. It will remove the human dependency and make the process function smoothly .
- You can access the code through **Toll_tax.py**[1]**.**
- A predefined database is there that is used to access the information corresponding to each RFID card number with the filename **Toll_tax.xls**[2].

Hardware Used

- **EM 18 MODULE**[3] : Used to scan RFID card.
- **USB TTL** :Used to form a link between Raspberry Pi and EM 18 Module.
- **16x2 LCD Display** : To display generated bill.

Software Dependencies needed:

Python 3.6 is used for this project.

Multiple software dependencies are to be installed.

1. **Install Xlrd library.**
   ```
   $ sudo pip install xlrd
   ```

2. **2.3 Install Xlwt library.**
   ```
   $ sudo pip install xlwt
   ```

3. **Install Xlutils library.**
   ```
   $ sudo pip install xlutils
   ```

Output

- When you run this, you'll see the list of vehicle type and their corresponding price for single and double trip respectively.
- After you've parked your vehicle, it is detected and after RFID card is scanned,it asks whether to go for single or double trip.

[1] www.github.com/taps1197/Smart-City/Smart-Toll
[2] www.github.com/taps1197/Smart-City/Smart-Toll
[3] www.google.com

- The bill is displayed on LCD Display screen, money deducted from your account and updated in database.

2. Smart Parking

- A smart parking which will scan your RFID card and display your name and information in the screen for a faster digitized process. It will be free from human error and make the parking run smartly digitally .
- You can access the code through **smartpark.py[4].**

Hardware Used

- **RFID CARD[5]** : Used to scan RFID card.
- **Ultrasonic Sensors** :Used to form a barricade system through time management and limit of the cars parked.

Software Dependencies needed:

Python 3.6 is used for this project.

Multiple software dependencies are to be installed.

1. **Install Xlrd library.**
   `$ sudo pip install xlrd`
2. **Install Xlwt library.**
   `$ sudo pip install xlwt`

Output :

When you run this, you'll see whether the cars are parked in a proper manner and parking lot is vacant or full of cars.

[4] www.github.com/taps1197/Smart-City/Smart-Toll
[5] www.google.com

3. Smart Dustbin

- To maintain a healthy and sanitary environment in the city we need to clean up the dustbins faster and adjust to the different human conditions like population,festivals etc.. Smart dustbins acts as a smart alternative for this.
- You can access the code through **sm_dust.py[6].**

Hardware Used

16x2 LCD Display : To display the status of dustbin.

Software Dependencies needed:

Python 3.6 is used for this project.

Multiple software dependencies are to be installed.

1. **Install smtplib library.**

```
$ sudo pip install smtplib
```

Output

When you run this, if the waste keep on piling up and reaches the limit, it will be automatically emptied for the upcoming disposal.

[6] www.github.com/taps1197/Smart-City/Smart-Toll

4. Smart Street Lights

- To ensure efficient lighting and display in night and through abrupt weather conditions .
- You can access the code through street.py[7].

Hardware Used

LDR (Light-Dependent Resistor) : It makes the system on when there is absence of light..

Output

When you run this, when there is absence of light in ldr , light will be provided immediately for convenience of the people.

[7] www.github.com/taps1197/Smart-City/Smart-Toll

5. Smart Agro Farming

- Lets see how farming too can be quite rewarding-both mentally and financially.
- You can access the code through **crops.py**[8]**.**

Hardware Used

Moisture sensor : It keeps track of the moisture of the soil .It informs about the water content in the soil before the crops get damaged.

Software Dependencies needed:

Python 3.6 is used for this project.

Multiple software dependencies are to be installed.

1. **Install tkinter library.**

```
$ sudo pip install python-tk
```

2. **Install request library.**

```
$ sudo pip install requests
```

Output

When you run this there will be notifications of low water content in soil and other agro parameters to keep the crop growth pace in a normal rate.

[8] www.github.com/taps1197/Smart-City/Smart-Toll

6. Home automation

- A home automation system will control lighting ,temperature parameters of the room.When connected with the internet ,home devices are an important constituent of the Internet of things
- Appliances can be handled manually for convenience.
- You can access the code through **homeautomation.py[9].**

Hardware Used

1. **Ultrasonic sensor :**Used to form a system to manage time .
2. **Bulb**: 230 W
3. **Servo Motor:** for curtains movement
4. **DHT11 sensor**(Temperature and Humidity sensor)

Software Dependencies needed:

Python 3.6 is used for this project.

Multiple software dependencies are to be installed.

1. **Install Adafruit_DHT library**

   `Download and install from the given link[10]`

2. **Install request library.**

   ```
   $ sudo pip install requests
   ```

Output:

- When you run this program it will ask you to select automatic or manual mode of operation.
- If you select manual mode then, you can change control the switch of bulbs and fans by using the technique of cloud computing through http://indianiotcloud.com/retrieve.php?id=N7BXFL2NUZ5Y .
- In automatic mode, it will automatically switch on lights if you are in the room and fans will turn on according to specified temperature and humidity.

[9] www.github.com/taps1197/Smart-City/Smart-Toll

[10] git clone: https://github.com/adafruit/Adafruit_Python_DHT.git

7. Hospital

- Healthcare facilities are connected to Internet of Things (**IoT**) devices to enhance., operational efficiency and the patient and resident experience.
- You can access the code through **hospital.py**[11]**.**

Software Dependencies needed:

Python 3.6 is used for this project.

Multiple software dependencies are to be installed.

1. **Install Xlrd library.**
   `$ sudo pip install xlrd`
2. **Install Xlwt library.**
   `$ sudo pip install xlwt`
3. **Install Xlutils library.**
   `$ sudo pip install xlutils`

Output

- Patient's diseases can be known through the feedback of patients symptoms.

- Patient's can fix an appointment with the doctor as per required and delivery of medicines can be done fastly and in safe hands.

[11] www.github.com/taps1197/Smart-City/Smart-Toll

How to Run this Code?

1. Download the project from Github.
    i. `git clone https://github.com/taps1197/Smart-City.git`
2. Run `auto_install.sh` in terminal for installing python dependencies.
3. Run smartcity.py to start the project login page.

Fig 1: smart city login page

4. Login using credentials.
    a. Username: smartcity
    b. Password: iot

5. Smart city Control Panel will start. From there you can select what type of service you want to access.

Fig 2: Smart city Control Panel

6. After going to hospital hospital management will start in terminal.

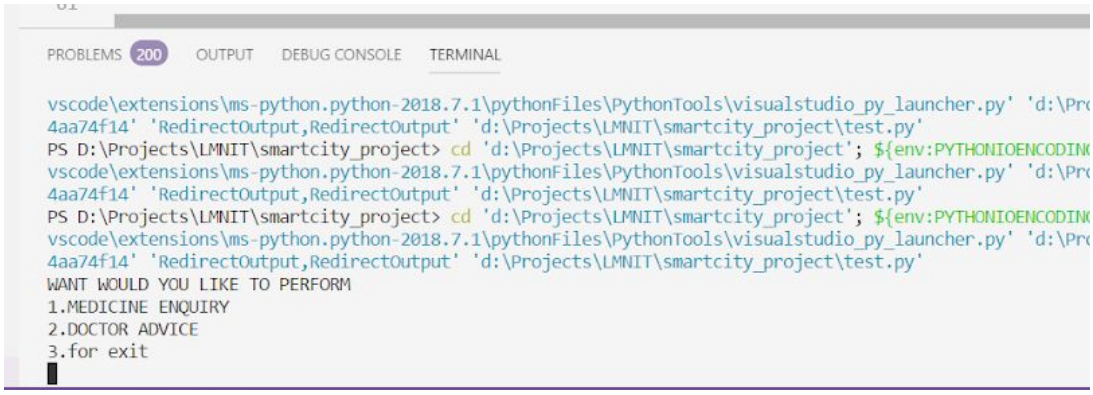


Fig 3: Remote Hospital Management will begin.

7. Select any option according to your needs.Selecting Medicine Enquiry.As head pain is issue then disease might be headache, and recommended medicine is Saridon.

```
WANT WOULD YOU LIKE TO PERFORM
1.MEDICINE ENQUIRY
2.DOCTOR ADVICE
3.for exit
1
                              WELCOME TO ONLINE MEDICAL STORE

SELECT SYMPTONS FROM BELOW

head pain,sensation of tightness,tenderness,pain across eyes,stiff neck,sweating,chills,muscle aches,dehydration,pain,pressure,squeezing,shortness of breath,arm weakness,fa
cial drooping,loss of vision,sudden weakness,severe headache,coughing of blood,pneumonia,wheezing,chronic cough,pain,tenderness,swelling,stiffness,redness,inflammation,ting
ling
head pain
PLEASE WAIT SYSTEM IS UNDER PROCESS...

YOU MIGHT SUFFER FROM DISEASE: headache
MEDICINE FOR  headache  is  Saridon

WOULD YOU LIKE TO BUY THE MEDICINES
1.YES
2.NO
```

Fig 4: Result of enquiry for head pain

8. If you like to buy medicine then enter the amount needed and delivery address and medicine will be delivered to the patient.

```
YOU MIGHT SUFFER FROM DISEASE: headache
MEDICINE FOR  headache  is  Saridon

WOULD YOU LIKE TO BUY THE MEDICINES
1.YES
2.NO
1
MEDICINE NAME          PRICE(RS)
Saridon                 30.0
INPUT THE REQUIRED QUANTITY
1
                                YOUR BILL INVOICE
MEDICINE               QUANTITY              PRICE          TOTAL
Saridon                 1                     30.0           30.0

############TOTAL AMOUNT TO BE PAID IN Rs 30.0 ############

ENTER DELIVERY ADDRESS
asas
DELIVERY TO THIS ADDRESS-- asas WILL BE DONE BY TOMMORROW.
THANK YOU FOR YOUR EFFORTS

do you want to quit
press 1 to quit
Else press any key to continue
```

Fig 5: Input quantity and delivery.

9. Fix an appointment with doctor fill the form.

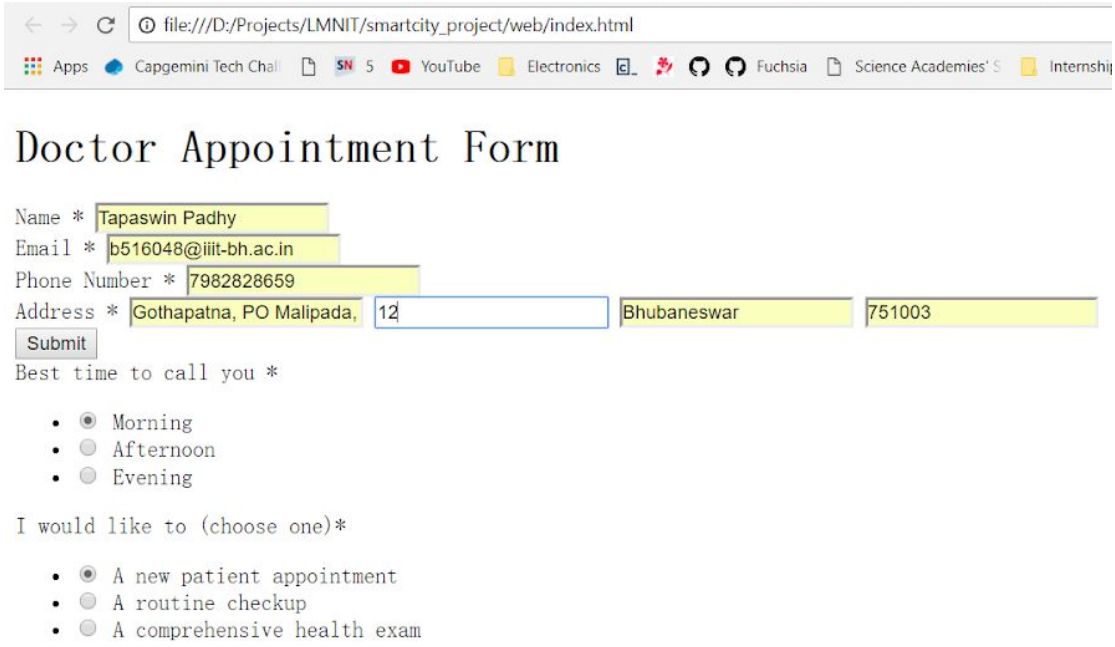


Fig 6: appointment fixing using web based client

10. For Live chat with doctor username, password, publish topic. This will connect you to the doctor for the subscribed topic.

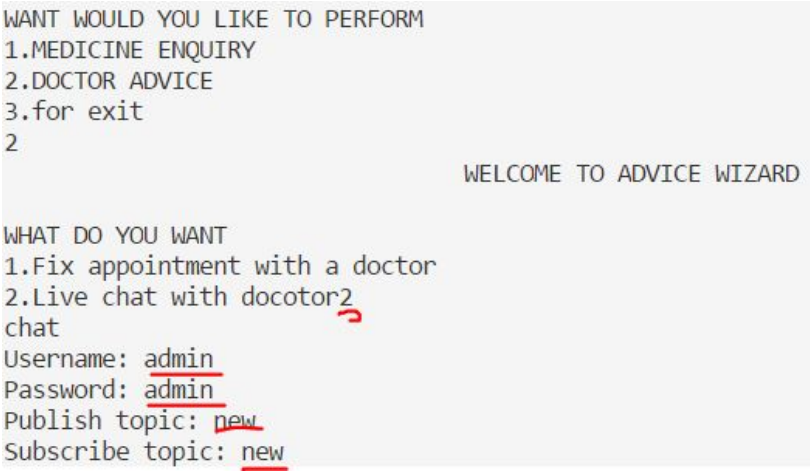
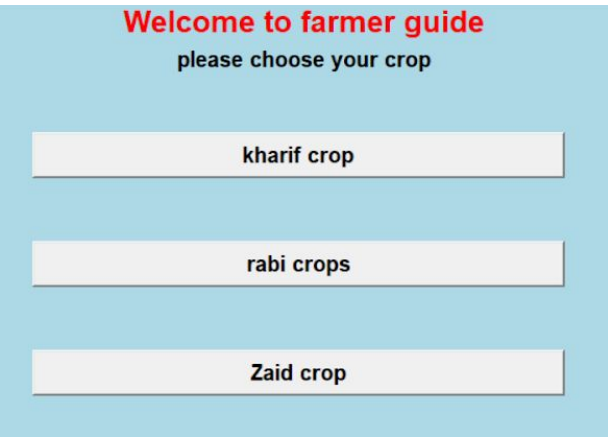


Fig 7: Live chat with doctor

11. Now run smart irrigation. It will open guide for farmer to know more about their crops.It will also trigger **DH11** sensor which will measure humidity and temperature data.



12. Now, run StreetLight it will trigger internal command for auto light shutdown connected to Raspberry Pi using LDR.
13. Run Smart Dustbin which will give notification to Raspberry pi connected LCD Display on filling of dustbin.
14. Run Toll Tax, When you run this, you'll see the list of vehicle type and their corresponding price for single and double trip respectively.
    a. After you've parked your vehicle, it is detected and after RFID card is scanned,it asks whether to go for single or double trip.
    b. The bill is displayed on LCD Display screen, money deducted from your account and updated in database.

15. Run Home automation it will automatically trigger bulb when no light is detected and it will send all the data to http://indianiotcloud.com/retrieve.php as JSON for further data analysis.

FUTURE SCOPE:

- This project can be implemented to a city to make it a **Smart City**.
- This is highly scalable project and API for every module can be generated.
- This can also be implemented in college to make a **Smart College**