Intelligent City: A Novel Approach for the Makeover of Conventional Cities using IoT

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Abstract- The transition of the Cities from being a simple bazaar to the present model with its stretches of roads, sky-scraping buildings, bus depots, and a lot more happened rapidly within the first decade of the twenty-first century. There are several difficulties associated with present-day cities. An intelligent city, which is also known as a cognitive city, is the next innovative solution for cities to deliver services efficiently and effectively to the citizens. It is an urban framework realized using IoT devices to gather data from the people and uses it to manage the assets and resources effectively. The user data is received using various input modules like portable camera units, the Infrared sensor modules, the ultrasound sensor modules, etc. This data obtained based on the application is processed to perform the required function. This processing can either use the image processing techniques or by using the well-perfected algorithms. Here, this work puts forth an intelligent city that gives solutions to many problems faced by the conventional cities and, it includes subsystems like Intelligent Traffic System (ITS), Intelligent Streetlight System (ISS), Intelligent Parking System (IPS), Intelligent Face Tracking System (IFTS) and TECH COV-AID.

Keywords- COVID, Face Tracking, Image Processing, Intelligent Traffic, Intelligent Streetlight, Internet of Things (IOT).

I. INTRODUCTION

A city is a symbol of human civilization. It is usually the center of political, administrative, and industrial activities. Also, it is a measure of the countries degree of urbanization. Urbanization in India is slow but sure death for villages and Villagers, says the Father of the Nation. The expansion of the cities indeed results in the engulfing of the Villages. But, the problems faced by human beings are changing rapidly in a dynamic manner. Therefore, innovations and technology is the need of the hour to deal with them. The former Prime Minister of India said that urbanization is the inevitable outcome of the growth and the process of modernization. So, the adoption of new technology and innovations will result in the progress of the country. Therefore, the process of urbanization can indeed result in the development of human beings as a whole. Also, such a city does not only change people's lifestyles but also paves the way for a better solution to the different problems that are faced by human beings. As a result, urbanization is synonymous with progress. The work, 'Intelligent City' which is known as a cognitive city is a solution to the growing limitation of the present conventional style cities like the hours we spend on a traffic intersection, etc. Actually, according to a report by TomTom, a Netherland based company, a Bengaluru resident spends an average of 243 hours in traffic in 2019 [1]. If this is extrapolated to include the entire population, the average number of hours could be somewhere around 200. Well, moving on to the amount of energy that we waste every year due to the continuous operation of the streetlight is about 60 percent of the total electricity produces in the country [2]. These are just two instances of the inefficiencies of the current cities. Hence, the work proposed here aims to overcome many of these shortcomings. Hence, it is an urban framework realized using various Internet of Things (IoT) [3] devices to gather data from the people and uses it to manage the assets and resources effectively. The user data is received using various input modules like portable camera units, the Infrared sensor modules, the ultrasound sensor modules [4] etc. This data obtained based on the application is processed to perform the required function. The intelligent city designed as part of this work includes subsystems like Intelligent Traffic System (ITS), Intelligent Streetlight System (ISS), Intelligent Parking System (IPS), Intelligent Face Tracking System (IFTS) and TECH COV-AID. ITS is an up-gradation to the existing road traffic system, where the traffic signals are controlled based on the density of vehicles on the road. However, it can be defined as a holistic solution to one of the greatest defects of the

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present-day traffic system. The ISS is another innovation where the streetlights are turned on only when necessary. Hence, it helps in saving a large percentage of electricity produced in the country. As a remedy to the problems like congestion of road due to the practice of parking vehicles on either side of the road and safety concerns of parked vehicles, this work includes IPS, which is well-monitored parking confinement.

COVID-19 pandemic was unprecedented and the impact of the disease in health and economic sectors is also huge. TECH COV-AID is a small scale platform for few stakeholders to fight this crisis. It includes two branches namely the hospital management system and essential grocery management system. Lastly, the IFTS helps in tracking the face of a person in a video, which can be used in many crucial applications. Hence, the intelligent city is the next way forward for mankind all around the world, but it should be planned very carefully particularly in balance with the environment. Figure 1 represents the illustrative model of the proposed intelligent city indicating all the different subsystems.

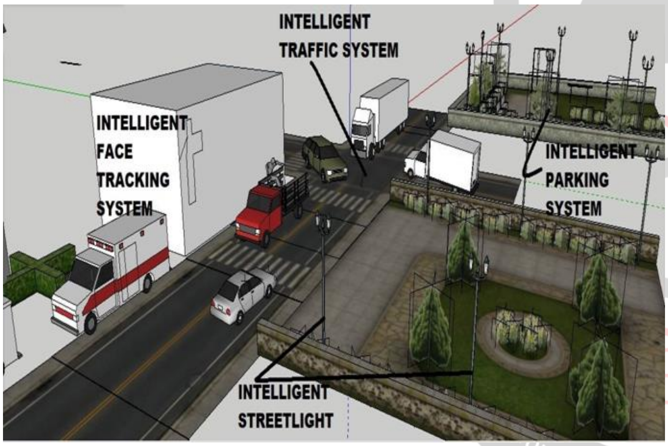

Figure 1: Three-dimensional view of the Intelligent City

II. LITERATURE SURVEY

This work, 'Intelligent City' was deliberated upon after careful investigation of quite a few research papers and books. Being the next big thing in the field of urbanization and in developmental studies, fine quality scientific documents weighting each and every perspective of digitizing the cities were available. The blueprint for this work was prepared after thorough analysis of the existing model and by including our ideas. Laura and Robertas have done a careful analysis of the need for the conversion to intelligent city in their research paper, which gave us strong reasons to justify the advantages of the intelligent city. Normally, urbanization is viewed as a threat due to the damage it could possibly inflict on the ecosystem but carefully planned intelligent city would not result into that. The set of five basic indicators were acknowledged [5] after keen analysis of various intelligent city like models available in few places across the world. Critical analysis of the application of the Internet of Things (IoT) technology in the intelligent city is clearly presented by Zanella, Nicola, Castellani, Lorenzo and Zorzi [6]. Apart from that, the experimental case study of the Padova smart city also clarified the incertitude associated with the practical implementation of the intelligent city. The discussion on the service specifications used for the Padova city case, gave a detailed picture of the methods used. The service specifications listed are with respect to the network type, traffic rate, tolerable delay, possible energy sources that could be used and a feasibility 7 study. Ben Green acknowledges in his book,' The Smart Enough City' that a limit does exist for urbanization [7]. He clarifies that judicious conversion to intelligent city is required to protect the balance between man and nature. Too much of anything is wrong therefore, a well-planned out conversion is required and that, it should satisfy the need of every stakeholder present. However, the newer problems faced by human beings are dynamic in nature. Therefore, Green do not completely rule out the idea of this conversion. Komninos and Nicos have outlined the ever increasing applications of the intelligent city [8]. According to them, broadband networks, software applications, e-services and datasets are the prime factor that results in causing changes to cities. Besides, A brief idea of the various techniques that could be possibly used in the realization of intelligent city was also presented by them.

III. PROPOSED SYSTEM

Intelligent Traffic System

The conceptual level block diagram for this system is shown in Fig 2. Various components of the intelligent traffic system can be broadly classified as power supply, microcontroller unit [9], traffic lights, and the camera unit as illustrated in Figure 2. Since one of the most important criteria of the ITS is portability. The system is designed to be battery operable. This system attempts to bring a solution to that problem by analyzing the traffic density and varying the time interval of each signal based on the traffic density. It works by processing the image captured at regular intervals from the road where the traffic needs to be regulated. Hence, the image processing toolbox of the MATLAB (Matrix Laboratory) was used to program the system, along with the image processing toolbox. This information is further used to decide the time for which the green light of the traffic light should be on.

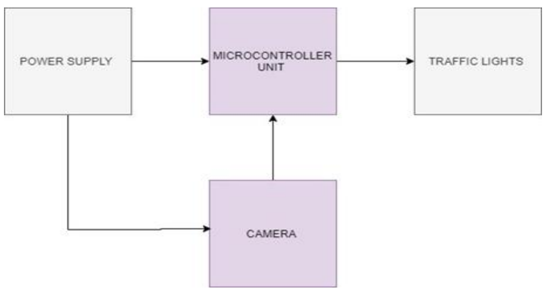

Figure 2: Block Diagram for Intelligent Traffic System

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Intelligent Streetlight System

A city's streetlight provides safer traffic conditions, safer pedestrian environment and can represent a great improvement to the city's architectural, touristic, and commercial output. The block diagram for the intelligent streetlight system is presented in Fig 3. It consists of three blocks namely the triggering systems, the control systems and the streetlights.

The idea behind an intelligent streetlight system is to light the streetlight only when an object is in the near range. This will help in conserving electricity by preventing continuous operation of streetlight throughout the night. The basic principle is to use a sensor like the infrared sensor or the ultrasonic sensor to detect the object. Based on the presence of the entity, the corresponding streetlights are turned on. The streetlights can be interconnected using IoT cloud services like Thingspeak, which helps in centralized monitoring. Hence, the reduction in power consumption and better monitoring is possible with this system.

Figure 3: Block Diagram for Intelligent Streetlight System

Intelligent Parking System

Well-monitored confinement for parking vehicles is the intelligent parking system. This system gives accurate data regarding the number of vehicles present in the parking space. The monitoring is done using object detection devices like the infrared sensor. The ESP8266 NodeMCU will be used here as the main controller to control all the peripherals attached to it.ESP8266 is the most popular controller to build IoT based applications as it has inbuilt support for Wi-Fi. Here also, the information is processed in IoT cloud services like Adafruit where the entering and exit time of the vehicle is updated. The block diagram for the intelligent parking system is shown in Fig 4. It broadly includes the power supply unit, the IR sensor unit, microcontroller unit, and the DC servo motor unit.

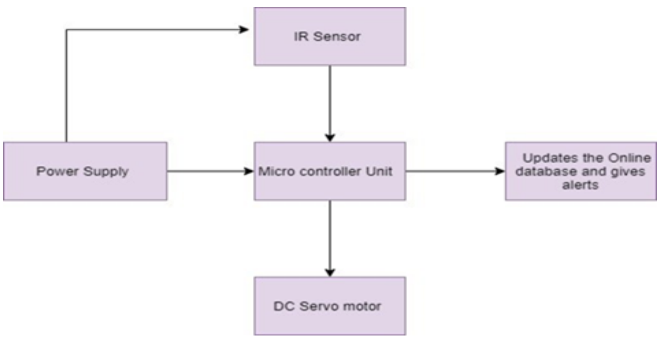

Figure 4: Block Diagram for Intelligent Parking System

Tech COV-AID

TECH COV-AID is a software project that serves the purpose of easing the crisis caused by the COVID-19 pandemic. It has two branches typically the hospital management system and the essential grocery billing system. The hospital management branch of the TECH COV-AID helps in monitoring the COVID cases and the other hospital functions [12] while the grocery billing system is a simple GUI that aids in automating small shops during the pandemic. Both these branches were realized by using complicated programming techniques in python 3.7.

Intelligent Face Tracking System

The basic principle behind this completely software-based subsystem is to identify the face of a person from a video and to track it all along the video. This kind of tracking helps in better accuracy rather than tracking from the images. The identification of facial features that are involved in this system can be done by using any one of the image recognition algorithms that are available presently. However, the algorithm used in this system is detailed in the next section. The realization of this software is through the computer vision toolbox available in MATLAB.

IV. WORKING OF ALGORITHM

Intelligent Traffic System

The image processing toolbox in MATLAB is used to build the ITS. In this system, the percentage match between the reference image (image of the road without any vehicle) and the measured image (image of the road taken in an interval of the same road) is calculated by using the following equation. In MATLAB, the images are stored as an array making it easier for processing. Here, both the reference image and the measured image undergo image processing techniques to improve the accuracy of the resulting percentage match between the two images.

$$percentMatch = No.ofpixelsmatched/totalno.ofpixels. \quad (1)$$

Once the percentage match is calculated, it is compared with the default preset values given by the operator. Based on this value, the green light of the traffic signal will be on for the respective time allocated. Say, if the obtained percentage Match is between 90 to 100, the time duration for the green light will be 5 seconds. As the percentage Match reduces, the time duration of green light will be longer to allow vehicles to cross the junction quickly.

Intelligent Streetlight System

The process starts by checking the LDR value, this is then used for distinguishing day and night. If the LDR value is above a particular threshold, then the system recognizes it as day, and hence no action is taken. However, if it is below a threshold value, the IR sensor starts the operation for detecting the objects. Eventually, if the object is detected then the corresponding streetlights are turned on. Subsequently, when the object goes out of the range, the corresponding streetlights are turned off as per preset value. Simultaneously, the LDR value, the sensor, and the LED details are updated.

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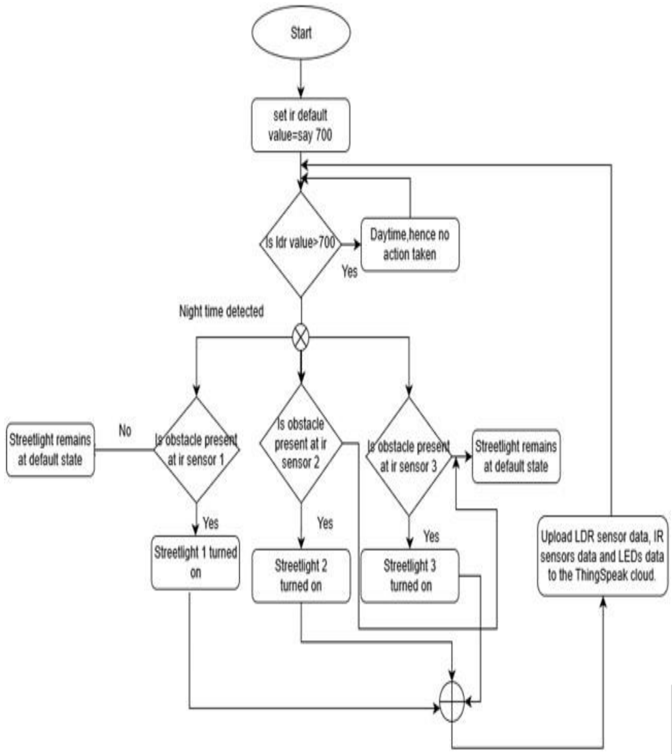

Figure 5: Algorithm for Intelligent Streetlight System

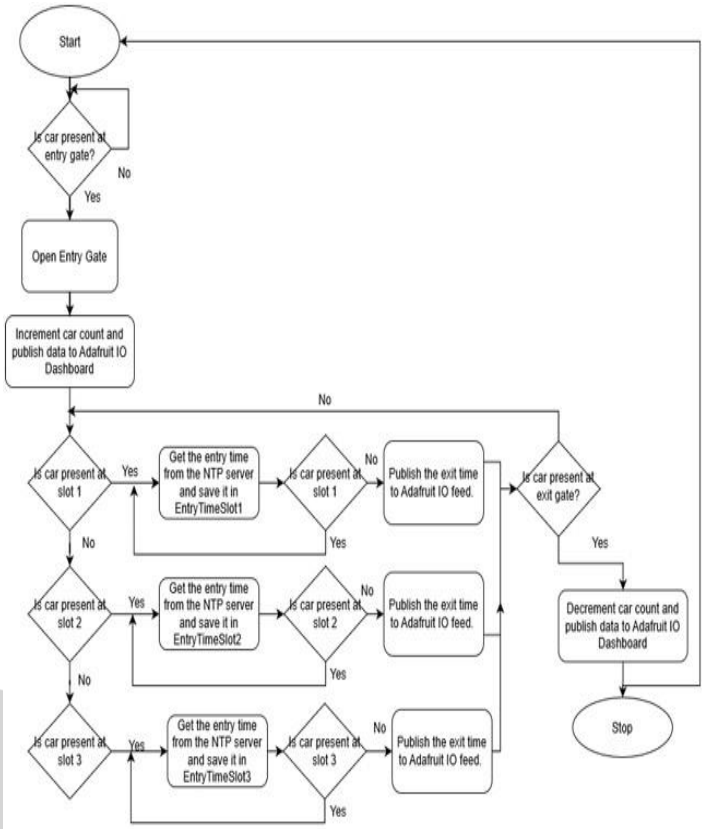

Figure 6: Algorithm for Intelligent Parking System

Intelligent Parking System

An intelligent parking system, as mentioned earlier is a well monitoring confinement, which is a real-time operation [11]. This system starts by checking whether there is a vehicle at the entry point. Based on the presence or absence of the vehicle the gates are opened or else it remains closed. As a vehicle enters the confinement, there is an increment in the car count specified in the Adafruit IO dashboard, by using the cloud services. Eventually, if the car is present in any of the slots, all the important details like the entry time, exit time gets updated in the dashboard, which is available in the public domain. As the vehicle leaves the confinement, the car count is decreased and the information is updated in Adafruit IO

dashboard. This is possible due to the Wi-Fi enabled MCU that is used in this system. The obtained information is processed using an ESP8266 NodeMCU which is the low-cost microchip that provides Wi-Fi connectivity. This microcontroller board is used to relay the information to the network that helps in consolidating the details using cloud services like Adafruit IO. The information obtained will then become available to the citizens which aid in efficiently monitoring the parking.

Tech COV-AID

The algorithm behind TECH COV-AID is to make use of programming in Python 3.7 to record the data, arrange the data, and to recall the data appropriately. Essential Grocery

Billing System is a simple GUI based application which is very easy to understand and use. It uses Tkinter module for the GUI. Hospital Management System is based on Python.

Tkinter is a Python binding to the Tk graphical user interface toolkit. It is the standard Python interface to the Tk GUI toolkit and is Python's standard GUI. This system mainly focuses on CRUD with search functionality. The design of this system is pretty simple so that the user won't get any difficulties while working on it.

Intelligent Face Tracking System

The input video is divided into several different frames and there are a lot of image processing techniques that are used for recognizing the face of the person such as mini-eigen feature or the canny filter etc. This face that is detected is then tracked all along the video by using a tracking algorithm.

V. IMPLEMENTATION

Intelligent Traffic System

Since the intelligent traffic system is based on image processing, it requires the capture of images by using a suitable image acquiring device like the camera. This image that is captured at regular intervals is sent to a suitable processing device like Arduino UNO which is

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based on an ATmega 328P microcontroller. Here, both the reference image and the measured images are processed using the image preparation techniques before finding the percentage match between the images. The image processing techniques [10] used are briefly given in the following section. Subsequently, based on the percentage match obtained, the microcontroller directs the traffic signals deployed to turn on according to the density of vehicles present on the road. The complete schematic of the ITS system is depicted in Fig 7. Furthermore, this present a layered architecture that depicts the functionalities of the traffic management system and showcases the different components presents that it comprises in the following segment.

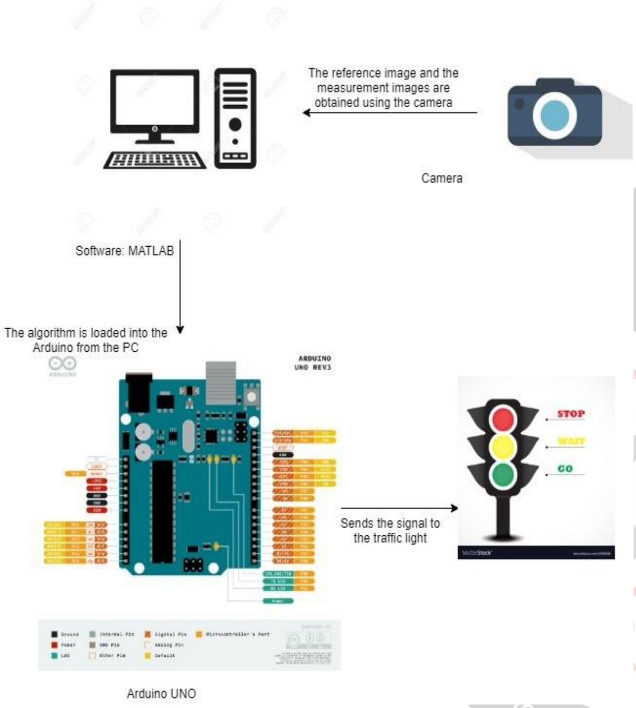

Figure 7: Schematic of Intelligent Traffic System

Camera System

The image acquisition motive of the intelligent traffic system is performed by using a digital camera module. A digital camera is a camera that encodes digital images and videos digitally and stores them for later reproduction. They typically use semiconductor image sensors. The device will capture the image real-time from the road at regular intervals and send this information to the computer. This information can be saved, reviewed, or modified based on the application.

In this work, iball CHD 20.0 webcam was used to serve the purpose. because it helps in capturing 20 MP still images and 2.1MP video resolution. This model was very suitable for this application. because it captures high definition images. Some of the characteristics of the camera unit used are given in Table 1. It gives details regarding the different parameters and their specifications provided by the camera that has been used in the work.

Sl.No	Parameter	Specification
1	Sensor Resolution	1 MP CMOSe
2	Interpolated Resolution	20 MP (Photo), 2.1 MP (Video)
3	Lens	5G wide angle lens
4	USB Interface	USB2.0., backward compatibility with USB1.1
5	Microphone	Build in USB Mic
6	Focus	Manual Focus
7	Max. Image resolution	5500 * 3640 pixels
8	Max. Video resolution	1920 * 1080 pixels.
9	Cable Length	1.5 m

Table 1: Specifications of the Camera used.

Image Processing System

Figure 8 shows the different steps involved in the image processing starting from image acquisition till the timing allocation. Rather than using electronic devices embedded in the pavement to detect the vehicles on the road, a better solution is to use image processing system due to the lesser man power required. In the image processing system, It is necessary to prepare the reference image and the measured image. As mentioned earlier, the image of the empty road serves as the reference image while the image taken at regular intervals of the same road is the measured image. These images are processed before finding the match between the images to increase the accuracy of comparison. Both the images are first converted from RGB to gray scale.

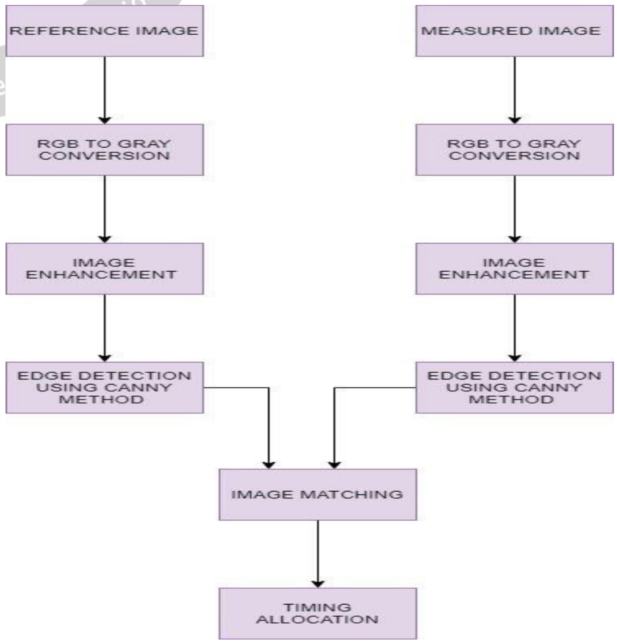

Figure 8: Image Processing Flowchart

For the image processing, the image that is captured as RGB by the camera is converted to gray scale, where each

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of the pixels will then represent the brightness of the respective pixel rather than the color variation. Then, this image is subjected to contrast enhancement by the histogram equalization. The resulting images are then compared to give us the percentage match. And based on the percentage match, the timing allocation for the traffic lights is done.

Microcontroller System

Arduino UNO based on ATmega328P is the microcontroller board that is used in this work. Here, the programming is done using the Matrix Laboratory (MATLAB), where the images are considered as arrays and analysis becomes easier. The single chip microcontroller was developed by ATMEL in the megaAVR family. Also, the Atmel 8-bit AVR RISC-based microcontroller combines 32 KB ISP flash memory with read-while-write capabilities, 1 KB EEPROM, 2 KB SRAM, 23 general purpose I/O lines,32 general purpose working registers, three flexible timer/counters with compare modes, internal and external interrupts, serial programmable USART, byte-oriented 2-wire serial interface,SPI serial port,6 channel 10-bit A/D converter (8-channels in TQFP and QFN/MLF packages),programmable watchdog timer with internal oscillator, and five software selectable power saving modes. Figure 10 shows the hardware implementation of the intelligent traffic system made during the course of the work.

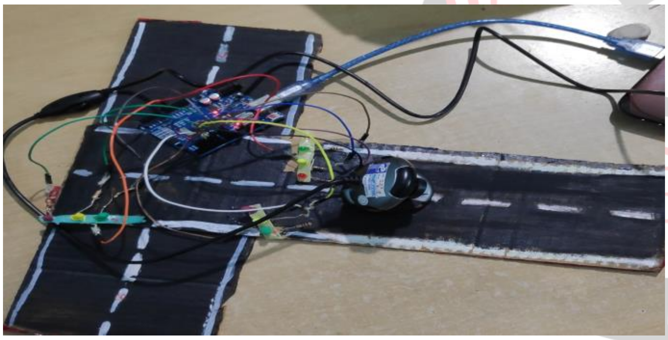

Figure 10: Hardware Implementation of Intelligent Traffic System

Intelligent Streetlight System

The intelligent streetlight system involves the detection of the object for intelligently controlling the streetlights deployed all over the field. The detection is possible by using either the infrared sensing techniques or the ultrasonic method. The information about the obstacle is sent to the microcontroller with Wi-Fi connectivity like the ESP8266 NodeMCU. Wi-Fi connectivity is necessary to connect the streetlights using IoT platforms like Thingspeak that helps in creating a centralized surveillance dashboard. In short, this interconnection helps in consolidating the information on a single platform. Since the main objective behind this system is to reduce power consumption by lighting the streetlight only when needed, it is essential to have a mechanism to distinguish day and night. This task is undertaken by the light depended resistor (LDR) in this system. Hence, the lights are controlled based on the LDR value. Apart from this, another control strategy is to on the bulb only when the object is in the near range. Here as well, the idea is to prevent continuous operation of streetlight all throughout the night that helps in curbing the loss of power. This control strategy is aided by the infrared sensing mechanism that is embedded on the pavement. The schematic of the subsystem consisting of the microcontroller, the programming unit, infrared sensor and the streetlight is shown in detail in Fig 11.

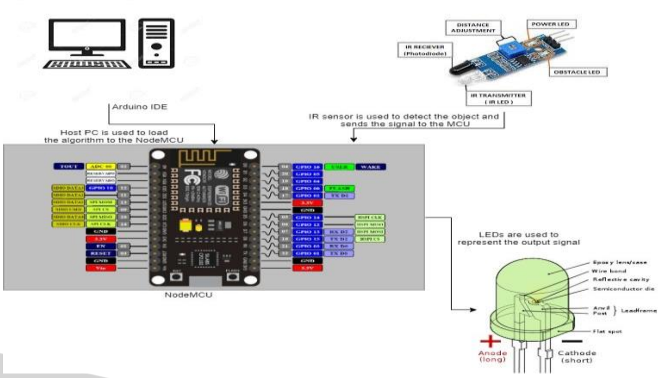

Figure 11: Schematic of intelligent streetlight system

Microcontroller System

Each of the streetlights is connected to the network for effective monitoring by a special feature present in ESP8266 NodeMCU. This low cost Wi-Fi microchip with full TCP/IP stack and microcontroller capability was produced by Expressif systems. It has a 1 MiB of built-in flash, allowing the building of single-chip devices capable of connecting to Wi-Fi.

The intelligent streetlight system is demonstrated on a road-like platform using toy cars, and the LED light resembles the streetlights as shown in Fig 12. Consequently, when the object enters the perimeter of a given streetlight, the corresponding

streetlight would be lit. This strategy will certainly help in saving electricity in a very efficient manner. Therefore, this model overcomes the problems caused by increasing energy prices and maintenance costs. The increasing expectation manifested by the public is also sufficed by this model.

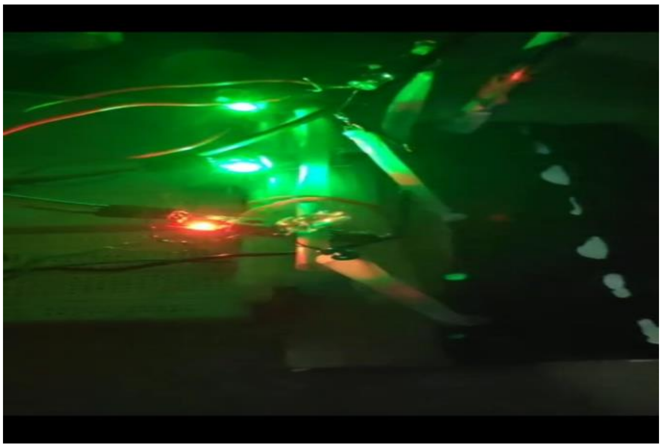

Figure 12: Hardware Implementation of Intelligent Streetlight System

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Intelligent Parking System

This system makes use of 3 IR Sensors and a NodeMCU. IR sensors are connected to the NodeMCU. It controls the entire process and sends the parking availability and parking time information to Adafruit IO so that it can be monitored from anywhere around the world using the platform. The required libraries ESP8266 Wi-Fi and Servo.h libraries were included. The Wi-Fi and Adafruit IO credentials from the Adafruit IO server are been copied that include the MQTT server, Port No, User Name, and AIO Key. The feed is then been set up and published. The Infrared sensors are been connected to the D0, D1, D2 pins respectively of the Nodemcu. The date and time of entry and exit is been updated whenever the user requests to NTP servers. After getting the data, store the hour, minute, and second in three different integers. The entry and exit IR sensor pins values are been read and checked if these pins are high. The data are been published to the Adafruit IO dashboard. If the IR sensor data is ‘1’ and Boolean function is false, then the entry time data was retrieved from the NTP server and was saved in EntryTimeSlot1 variable and variable data was published to the Adafruit IO feed. When the IR sensor pin changed to zero and the Boolean function turned true, the exit time was published to Adafruit IO feed. Similar steps were repeated for slot2 and slot 3 sensors. Figure 13 shows the schematic of the parking system illustrating the different software and hardware components used.

Sl.No	Percentage Match	Time allocation for the green signal (in seconds)
1	90-100	10
2	70-90	20
3	50-70	30
4	10-50	60
5	0-10	90

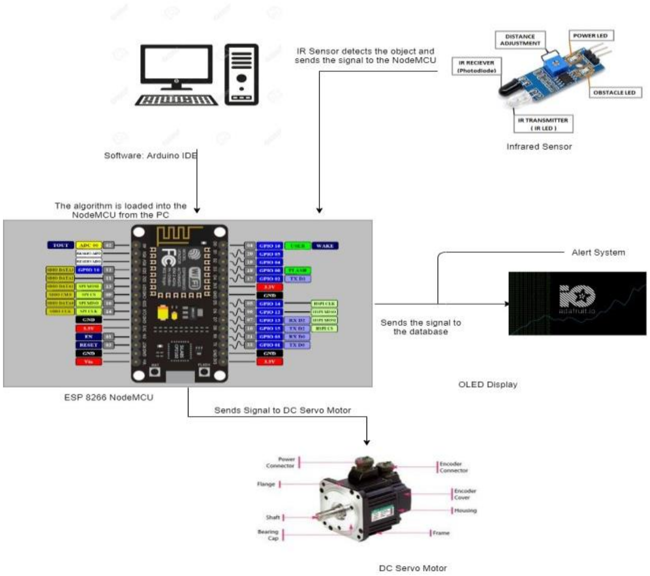

Figure 13: Schematic of Intelligent Parking System

In the hardware implementation of the parking system shown in Figure 14, a three slot pathway is made using cardboard and the parking process is facilitated by toy cars. Eventually, as the car enters the confinement, the IR sensor triggers the DC servo motor to open the gate. Then, as it enters a parking slot out of the three, corresponding IR sensor updates the information in the Adafruit IO cloud. Besides, this processing is done in Arduino IDE by using ESP8266 library, servo library and Adafruit library.

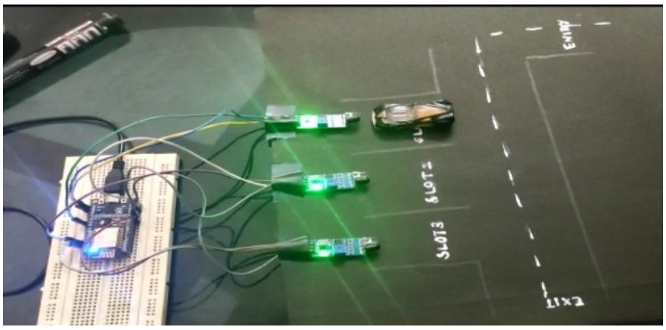

Figure 14: Hardware Implementation of Intelligent Parking System

VI. RESULTS AND DISCUSSIONS

Intelligent Traffic System

The output obtained was in line with the time allocation which was previously fed into the system. Besides, the output is represented in table 2 which gives the percent match ranges and the time allocation for the green signal with varying percentage matches obtained.

Table 2: Intelligent Traffic System

Figure 15: Reference image

Figure 15 represents the reference image obtained when there are no vehicles on the road.

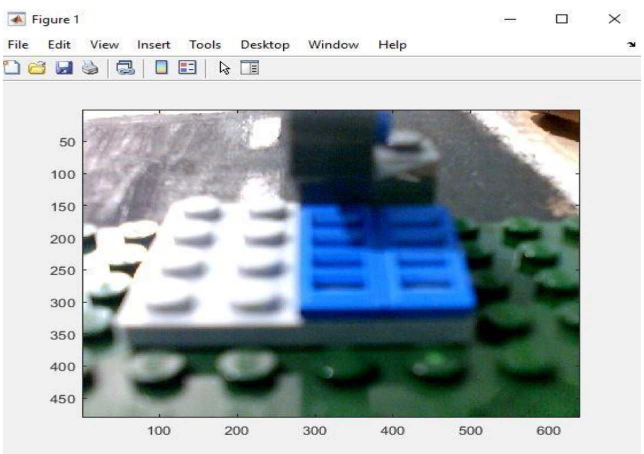

Figure 16: Measured image

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Figure 16 depicts the measured image at a particular instant while running the intelligent traffic system when the road experiences varying density of traffic.

Intelligent Streetlight System

Fig 17 represents the variation in LDR obtained while experimenting the intelligent streetlight system. The graph shows the plot between the intensity of the LDR at different times of the day .The LDR is sensitive to light and its resistance changes according to the intensity of light falling on it. Its resistance increases in darkness and decreases in light as observed in the field charts obtained.

Figure 17: Thingspeak: Variations in LDR

These variations are obtained real-time in Thingspeak which provides cloud service for IoT devices.

Figure 18 and 19 represents the variations in streetlight and the IR sensor during the operation of the streetlight system. The Figure 18 shows that the particular streetlight was on during the time interval from 12:35:05 to 12:35:15.Similar plots are also obtained for each of the streetlight that has to be monitored. The streetlight could also be turned on or off from the Thinkspeak platform as well.

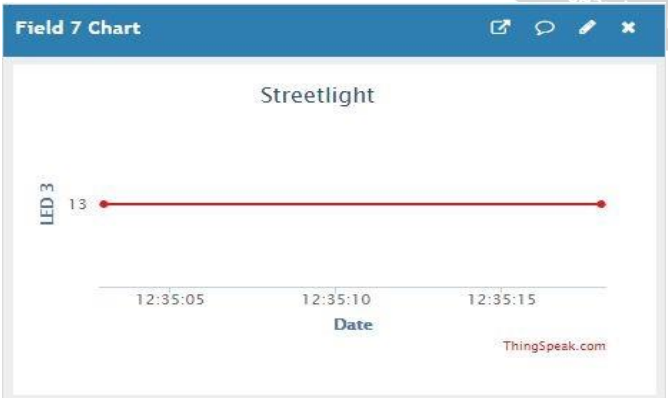

Figure 18: Thingspeak: Variations in Streetlight 1

The Figure 19 represents the plot of the IR sensor with respect to time. The graph shown in Figure 19 was recorded when the infrared sensor detected the absence of the car or any other obstacle during a particular time period. Thus the streetlight remained off for the given interval. The graph goes high when an obstacle is detected.

Figure 19: Thingspeak: Variations in IR sensor

Intelligent Parking System

The dashboard for the intelligent parking system is shown where the entry time and the status of each slot is visible in real-time. Figure 20 shows the plot for EntrySlot2, the graph indicates Boolean high-low values. The high value indicates the presence of vehicle in the slot and the low value indicates the absence, also the values are updated in real-time.Similiar plots could be obtained for N number of parking slots.

Figure 20: Adafruit: Dashboard

TECH COV-AID

Fig 21 is the console for the hospital management system that is been proposed. The user as well as the admin could perform their required actions and also know the COVID-19 status using the CRUD with search functionality.

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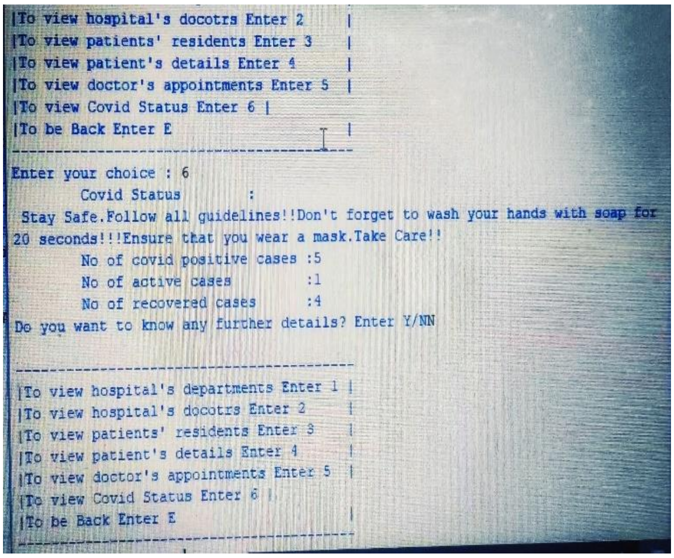

Figure 20: TECH COV-AID: Hospital Management System console

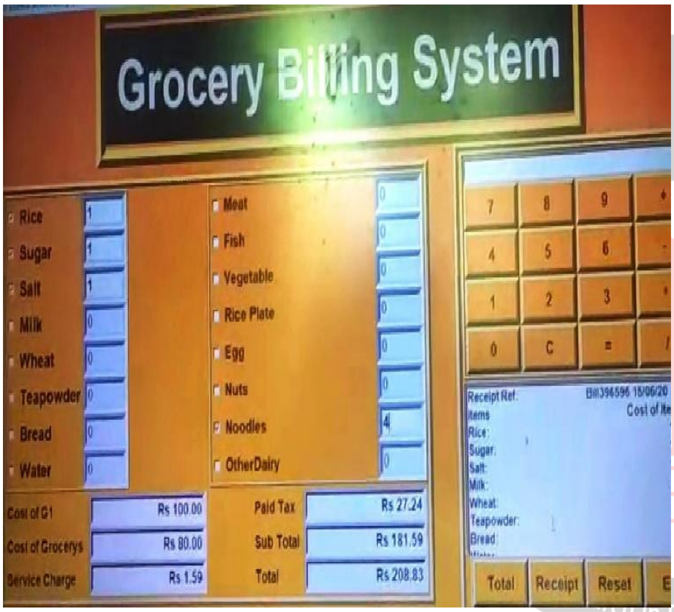

Figure 21: TECH COV-AID: Grocery Billing System console

Figure 21 shows the GUI of the Grocery Billing system made using python Tkinter and it also illustrates a sample selection of the essential grocery along with the total receipt due inclusive of all the taxes that has to be paid.

Intelligent Face Tracing System

Fig 22 and Fig 23 represents the output obtained after running the intelligent face tracking system.

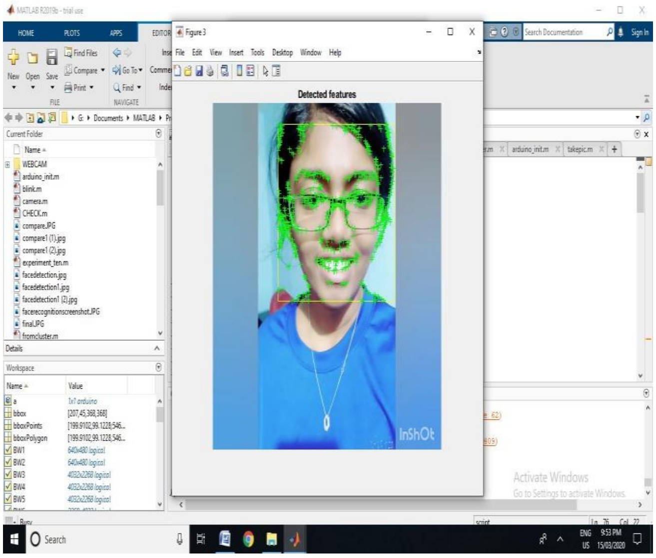

Figure 22: Intelligent Face Tracking System: Output 1

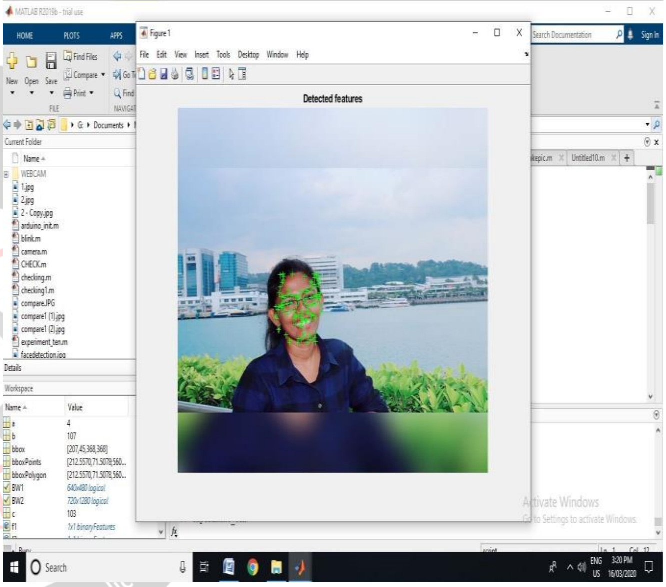

Figure 23: Intelligent Face Tracking System: Output 2

VII. CONCLUSION

Heavy dependence on conventional sources of energy has led to a reduction in the existing stock of these resources and has equally affected the ecosystem due to the release of harmful gases in the atmosphere. Therefore, the activities in the cities need to be tailored to achieve energy efficiency. The work, Intelligent City is on the direction of reducing the dependence of energy by making the systems like traffic management system, parking system, streetlight system, and face tracking system energy efficient by using image processing and Internet of Things technologies. This is proved by the investigation results of the paper given below. Firstly, the traffic management subsystem with its image processing technique that is used to calculate the density of vehicles on the road saves the electricity by modifying the time for which the green signal is turned on just for the vehicles to pass. Apart from energy saving, it also tried to reduce the waiting time in a traffic crossing.

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Secondly, the results of the implementation of the intelligent streetlight system proved the factual basis for saving electricity by preventing the continuous operation of streetlight throughout the night. Thirdly, the parking system performs a centralized control in a normal parking slot. Lastly, the face tracking system tracks the face with great accuracy in a video, paving ways for further use of this data.

An unprecedented pandemic like the COVID 19 throws new challenges to mankind, hence the TECH COV-AID subsystem of this work is a methodology to deal with the problems faced by the otherwise disparaged entities like small grocery shop owners and hospital management agencies. It tried to equip them to handle the difficulties in a much easier manner. Consequently, the intelligent city with its cognitive solution tries to overcome most of the difficulties associated with it.

VIII. FUTURE SCOPE

The traffic lights that are installed all over the roads are of a conventional style which results in an inefficient system, therefore, techniques similar to intelligent traffic system that makes use of image processing will help us in saving both time and effort. The presented one can further be expanded to include other image processing algorithms as well. The parking system needs to be implemented in every nook and corner of our country to reduce the disruption of the road due to the parking of vehicles on the sides. Various ideas like multilevel parking can be incorporated along with this. Efficiency in power consumption is the need of the hour. This can be ensured by the intelligent parking system that is highlighted in the work, but it can be further developed by using fatly responding microcontrollers. The intelligent tracking system allows us to deal with identifying people for our home safety or crime investigation because it is better to recognize people from a series of video frames than from still images. The scope of this system includes the usage of more accurate person recognition algorithms.

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