Industrial Engineering Journal
ISSN: 0970-2555
Volume: 52, Issue 4, No. 1, April 2023

IoT-BASED SMART KITCHEN INCLUDING LPG CYLINDER WEIGHT MONITORING SYSTEM

K.N.V.Satya Narayana, Assistant Professor, ECE Department, V Tejasri Assistant Professor, IT Department S.sai Manikrishna, T.anu Saranya, D.s.p Karthik, S Minisha 4/4 SRKREC.

ABSTRACT:
In India, liquefied petroleum gas (LPG) is widely used for cooking in household. But the people are unaware about the daily consumption of the gas and the time frame when they have to book or refill. liquefied petroleum gas is a highly flammable and if it is not used carefully that can be dangerous and even lead to cause death. Even the most of the fire accidents in the household are due to the leakage of the gas. So, in this project we developed an internet of things (IOT) based system which monitors different aspects in kitchen such as gas leakage, smoke detection, fire detection, etc. it also sends this data to user via mail and mobile application named blynk. this system continuously monitors the cylinder weights and send user an alert to book a new cylinder via mail and mobile. This system is also inherited with some home automation features like controlling kitchen appliances like lights, exhaust fan etc. by using mobile application named blynk.

KEY WORDS: home automation, LPG leakage detection, LPG weight monitoring, internet of things, blynk, flame sensor, gas sensor, load cell.

INRODUCTION:

In India, Nine out of ten homes use liquefied petroleum gas cylinders. Liquefied petroleum gas (LPG) is widely used for cooking in households. But these LPG cylinders have some disadvantages. The most common problems with LPG cylinders are gas leakages. Which is causing countless deaths, burn injuries, and property damages. Among the reasons behind fire accidents, gas leakage is second to electrical short circuits. Another common problem is users are unconscious of the daily utilization of the gas and the time span when they have to book or refill. Liquefied petroleum gas is highly ignitable; if LPG is used carelessly, it can be life-threatening. So, in this project we developed an internet of things (IoT) based system. The Internet of things generally refers to the connection of sensors with physical objects, and software. It transfers the data through any communication network without any predefined connections. This IoT has many applications in which one of them is our design named smart kitchen. Generally smart refers to a solution designed by the latest technologies to a most commonly occurring problem. This design monitors different aspects of the kitchen such as gas leakage, smoke detection, fire detection, etc. it also sends this data to the user via mail and a mobile application named Blynk. this system continuously monitors the cylinder weights and sends users an alert to book a new cylinder via mail and mobile. this system is also inherited with some home automation features like controlling kitchen appliances like lights, exhaust fans, etc.. by using the mobile application.

Industrial Engineering Journal
ISSN: 0970-2555
Volume: 52, Issue 4, No. 1, April 2023

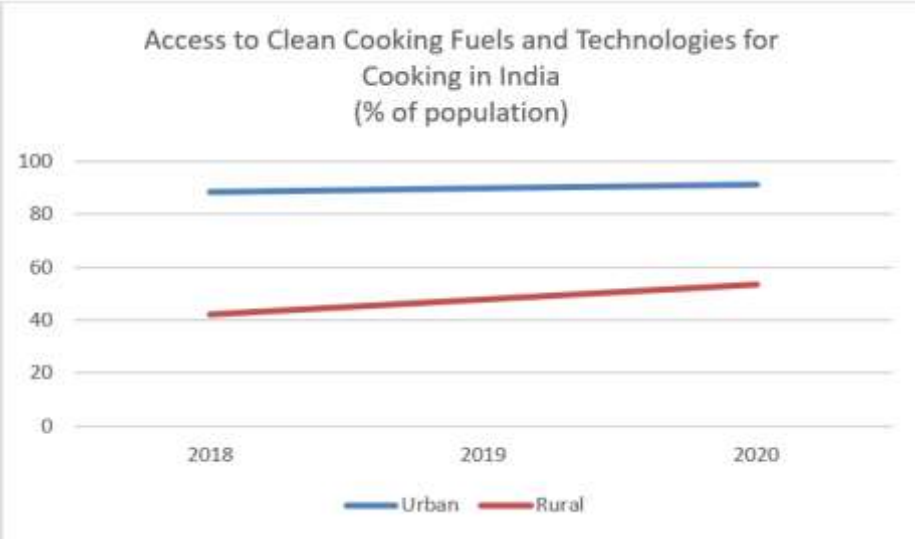

Fig1: usage of LPG in both urban and rural.

LITERATURE SURVEY:

The system [1] proposed by Arpit Kumar uses ATmega328P 16 as microcontroller and uses load cell to measure the weight of the cylinder and uses MQ-6 sensor to detect the gas leakage. for intimating users, it uses 16*2 lcd display and buzzer. it uses wifi module to interface with internet and sends the alert notifications through mail and mobile application.

the system [2] proposed by Kumaran MS uses esp32 as microcontroller and uses load cell to measure weight of the cylinder and uses MQ-6 sensor to detect the gas leakage. for intimating users, it uses 16*2 lcd display and blynk application. the gas regulator is controlled by using dc gear motor through relay.

Mrs. varsha R. palandurkar proposed a system [3] that uses ATmega328P 16 as microcontroller and uses MQ-5 sensor to detect the gas leakage. load cell is used for measuring the weight of the cylinder. it uses flame sensor to detect the fire and DHT sensor to monitor temperature and humidity.

The system [4] proposed by Alan Macker uses ATmega328P 16 as microcontroller and uses load cell to measure the weight of the cylinder and uses MQ-4 sensor to detect the gas leakage. For intimating users, the 16*2 lcd display and GSM module is used for sending SMS to user

EXISTING MODEL:

From the above literature survey, the systems that are implemented share a common architecture to monitor the LPG inside the cylinder and to take reactive actions of the parameters.

The fig below shows the block diagram of the existing system.

Industrial Engineering Journal
ISSN: 0970-2555
Volume: 52, Issue 4, No. 1, April 2023

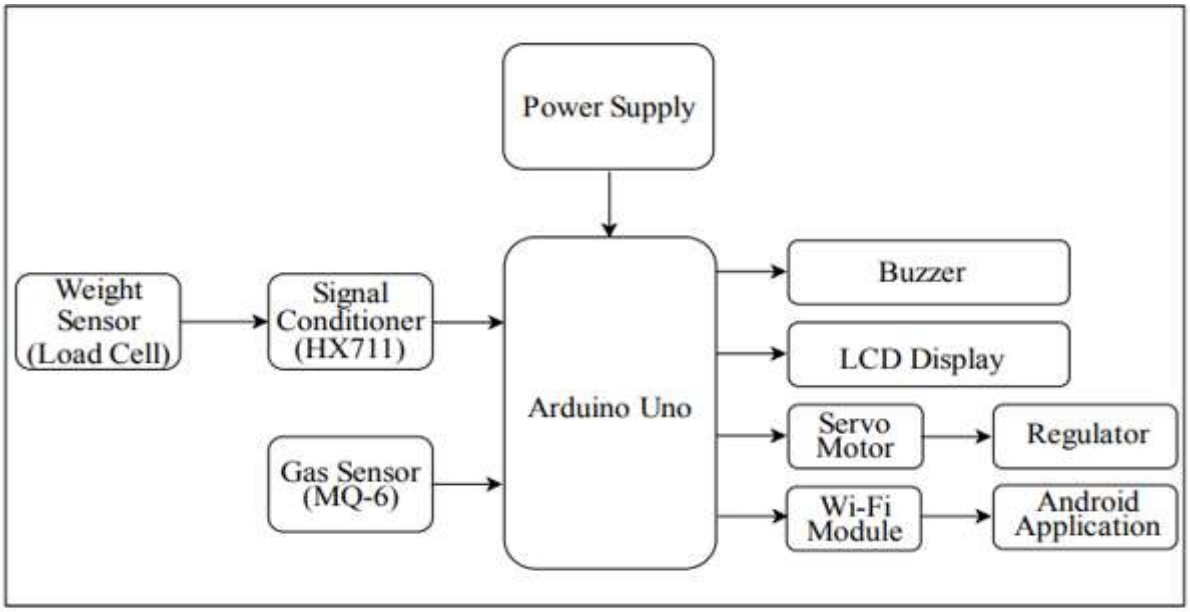

Fig2: block diagram of Existing system.

The architecture in the above fig uses the ATmega328P 16 as a microcontroller. To measure the weight of the LPG cylinder, A load cell is used that gives analog values. These values are displayed on the LCD display and the wifi module is used to connect the system with internet and send the same data to user via mobile application. The MQ-6 sensor is used to detect the gas leakage in the kitchen. When gas leakage is detected, the system turns on the buzzer and sends the alerting msg to user via mobile application. The servo motor is used to control the regulator of the LPG cylinder. The regulator is turned off when there is a gas leakage.

The system also sends the alerting notification when to book or refill the LPG cylinder. When the weight of the LPG cylinder is less than the defined value.

PROPOSED SYSTEM:

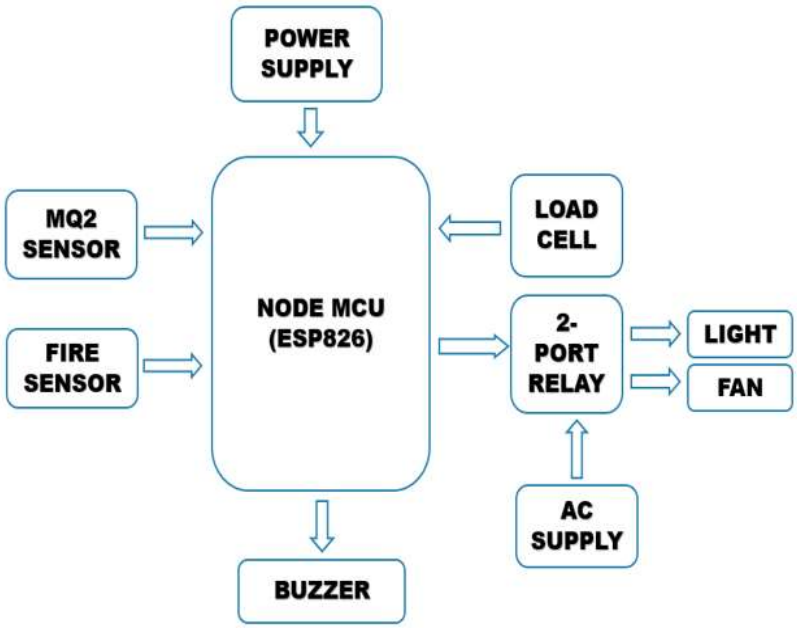

Fig3: block diagram of the proposed system

This paper mainly focuses on monitoring various aspects in the kitchen such as LPG weight, gas leakage, fire and smoke. The block diagram of the system that all these operations are given in fig. The microcontroller used in our system in ESP8266(NodeMCU). For monitoring the weight of the LPG cylinder, a load cell with HX711 amplifier is used. The MQ-2 sensor is used to detect the gas leakage and Flame sensor is used to detect the fire. The two-port relay is used to control the appliances in the kitchen. The red LED is used to indicate gas level in the cylinder.

The blynk mobile application is used to send the data to the user. The user can control the appliances by blynk application. The explanation of the sensors and modules are explained as follow

1.NODEMCU:
NodeMCU is a microcontroller board which is developed by the Espressif systems. The NodeMCU contains a built-in wifi module which helps it to connect with internet. The NodeMCU is a 40-pin dip IC. It can be programmed and run over the Arduino IDE by just adding related libraries in Arduino IDE.

2.LOAD CELL:
Load cell is a type of transducer which convert the pressure or tension into the electrical energy. The most common types of load cells are strain gauges, hydraulic and pneumatic. The most commonly used load cell is a strain gauge load cell.

The one end of the strain gauge load cell is stationary and the pressure or weight is applied at the other end. The operation of the strain gauge load cell can be explained by wheat stone bridge circuit.

3.HX711:
The output of the load cell is in analog form but the controller only accepts the digital data. For that purpose, the HX711 is used. It is an analog to digital converter which convert analog values into digital whenever the weight is applied on the load cell. It also amplifies the weak analog signal into strong digital signal.

4.MQ-2 SENSOR:
The MQ-2 sensor is one of the popular one in MQ sensor series. These MQ sensors are used for detecting various gas in air. The MQ-2 can detect the following gases like H2, LPG, CH4, CO, alcohol, smoke and propane. The MQ-2 sensor consists of 4-pins, there namely VCC, GND, A0 and D0. This sensor can operate in both analog and digital modes.

4.FLAME SENSOR:
Flame sensor is one kind of detector which is for detecting flame or fire. This sensor detects the light waves in the range of 760nm-1100nm. It can easily damage at high temperatures. It consists of 4 pins there are namely VCC, GND, A0 and D0. It is operated in digital mode.

WORKING OF THE PROPOSED SYSTEM:
As discussed in the proposed system, the weight of the LPG cylinder is monitored by using load cell. The load cell is mounted in between two wooden plates. The terminals of the load cell are connected to the one end of HX711 and the another end is connected NodeMCU. MQ-2 sensor is used for detecting gas leakage and smoke in the kitchen. The MQ-2 sensor is operated in digital mode, so D0 pin of sensor is connected to NodeMCU. The Flame sensor detects the flames in the kitchen and it is used operated in digital mode. The D0 pin of sensor is connected to the NodeMCU. The output of the load cell is in analog form, it is converted into digital by HX711 Amplifier. The reading from these

Industrial Engineering Journal
ISSN: 0970-2555
Volume: 52, Issue 4, No. 1, April 2023

sensors is given to NodeMCU board and it push this data into blynk mobile application with the help of internet. The two-port relay allows the user to control the appliances through blynk application since the system is connected to internet.

The flow chart for monitoring the LPG weight is given below:

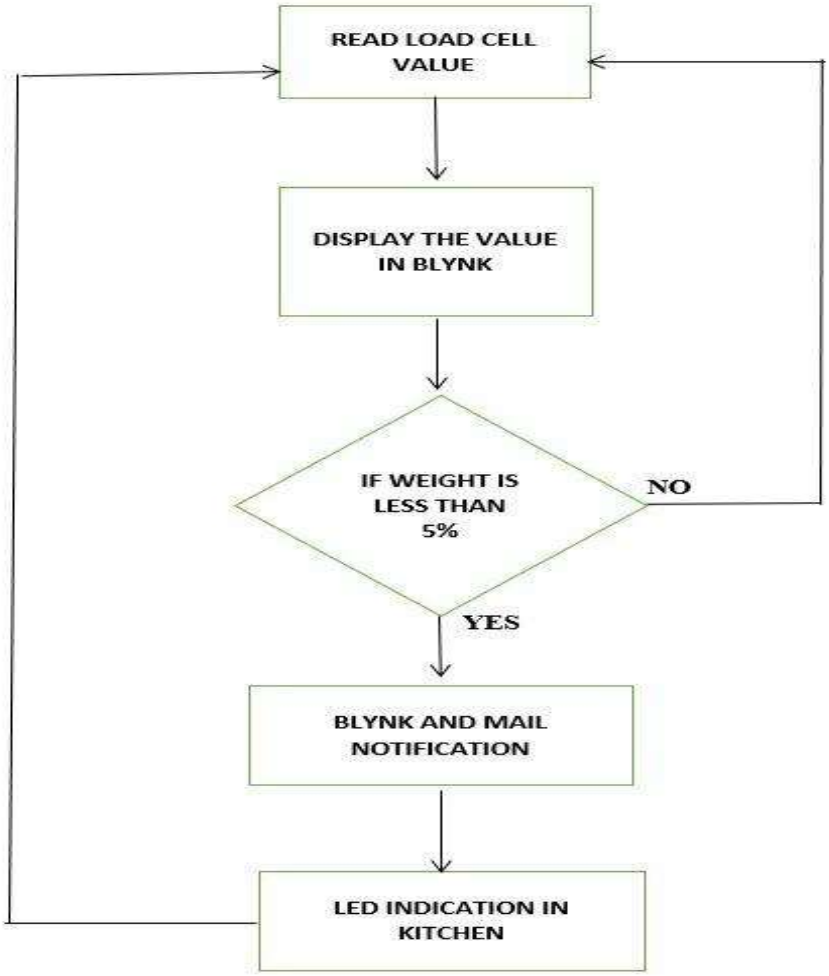

Fig4: Flow chart for gas booking alert.

The above flow chart explains the monitoring of the load cell. When the cylinder is placed on the load cell then it sends the reading to NodeMCU and it compare the value with the predefined value. If the value is less than the predefined value than it sends a mail and blynk notification to book or refill of cylinder.

The flow chart for monitoring the Flame and MQ-2 sensors:

Industrial Engineering Journal
ISSN: 0970-2555
Volume: 52, Issue 4, No. 1, April 2023

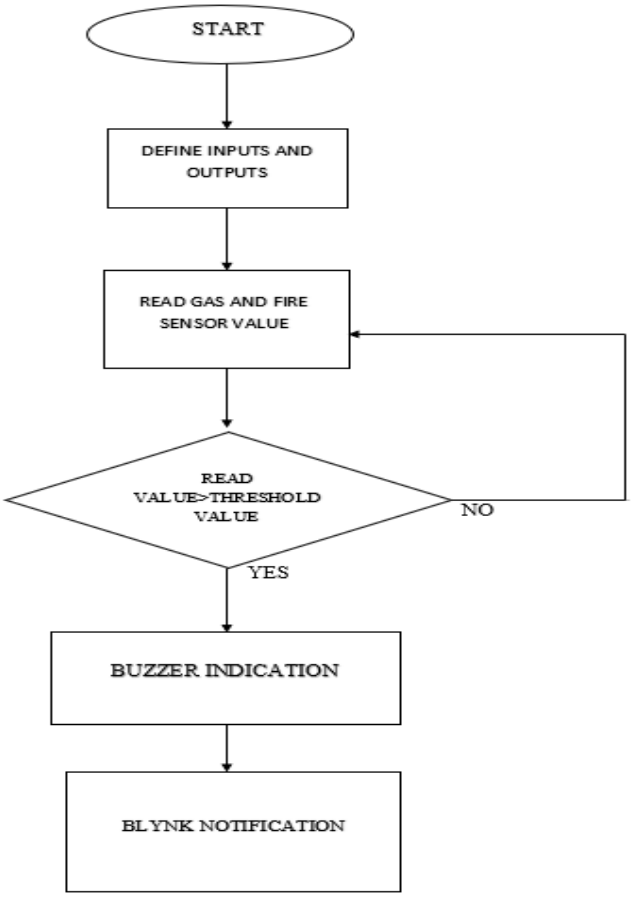

Fig5: flow chart for gas and fire detection.

The above flow chart explains the monitoring of MQ-2 and Flame sensor. When the sensors are connected to the controller board they will get power supply through controller and the sensor start reading the values. Then they send these values to controller and it compare them with predefined condition. If it is true the it will turn on the buzzer and send the alerting notification to user via mail and blynk application. If it is false then the sensor continuously reads the values.

The final experimental setup of the system is shown in the below fig.

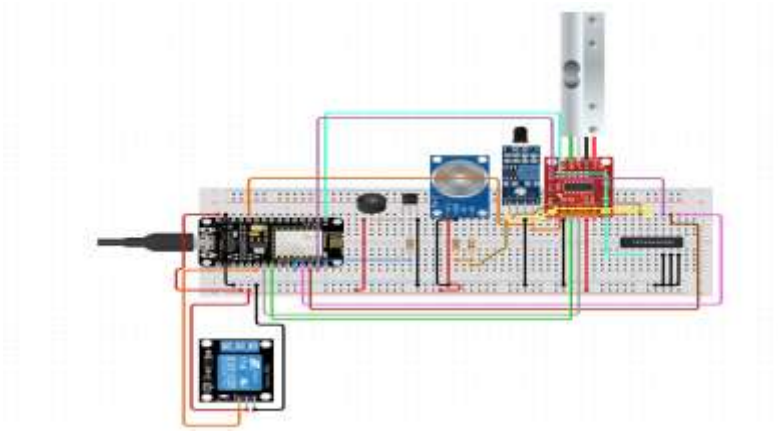

Fig6: circuit diagram for the complete system.

Industrial Engineering Journal
ISSN: 0970-2555
Volume: 52, Issue 4, No. 1, April 2023

RESULTS:

Industrial Engineering Journal
ISSN: 0970-2555
Volume: 52, Issue 4, No. 1, April 2023

```
10:01:31.937 -> gas value is: 1
10:01:31.977 -> fire value is: 1
10:01:32.017 -> gas  not detected
10:01:32.017 -> fire not detected
10:01:34.031 -> weight reading: -4.71
10:01:34.031 -> gas value is: 1
10:01:34.031 -> fire value is: 1
10:01:34.111 -> gas  not detected
10:01:34.111 -> fire not detected
10:01:36.102 -> weight reading: 158.00
10:01:36.102 -> gas value is: 1
10:01:36.102 -> fire value is: 1
10:01:36.190 -> gas  not detected
10:01:36.190 -> fire not detected
10:01:38.189 -> weight reading: 160.40
10:01:38.189 -> gas value is: 1
10:01:38.189 -> fire value is: 1
10:01:38.229 -> gas  not detected
10:01:38.229 -> fire not detected
10:01:40.268 -> weight reading: 160.39
10:01:40.268 -> gas value is: 1
10:01:40.268 -> fire value is: 1
10:01:40.306 -> gas  not detected
10:01:40.306 -> fire not detected
10:01:42.348 -> weight reading: 161.04
10:01:42.348 -> gas value is: 1
10:01:42.348 -> fire value is: 1
10:01:42.388 -> gas  not detected
10:01:42.388 -> fire not detected
10:01:44.405 -> weight reading: 161.50
10:01:44.405 -> gas value is: 1
10:01:44.405 -> fire value is: 1
10:01:44.485 -> gas  not detected
10:01:44.485 -> fire not detected
10:01:46.479 -> weight reading: 161.53
10:01:46.479 -> gas value is: 1
10:01:46.479 -> fire value is: 1
10:01:46.558 -> gas  not detected
10:01:46.558 -> fire not detected
10:01:48.557 -> weight reading: 162.15
10:01:48.557 -> gas value is: 1
10:01:48.557 -> fire value is: 1
```

fig7: Results

CONCULSION:

In this paper, the system proposed is to avoid human loss and property loss due fire accident in the kitchen and it will also provide the additional feature like monitoring the weight of the LPG cylinder, gas leakage and smoke detection. This system will continuously monitor LPG cylinder weight and when the weight of cylinder is less than the 15% of cylinder weight then it will send a notification to user via mail and blynk application to book or refill. It will also send notification to the user when there is a gas leakage or fire accident.

FUTURE SCOPE:

- Automation of LPG booking with interfacing of GSM module and also google assistance
- We decided to work and make it a proper model or proper automation kit for our feasibility.
- Work on its PCB designing to make it a proper model or proper automated kit and that's we use it in our kitchens as a readymade item.
- Blockchain based IoT can be implemented to secure the environment from any vulnerable personnel.

REFERENCES:

[1] Srivastava, Arpit Kumar, et al. "IoT based LPG cylinder monitoring system." *2019 IEEE International Symposium on Smart Electronic Systems (iSES)(Formerly iNiS)*. IEEE, 2019.

[2] Kumaran, M. S., et al. "Smart LPG cylinder monitoring and explosion management system." *2021 12th International Symposium on Advanced Topics in Electrical Engineering (ATEE)*. IEEE, 2021.

[3] Palandurkar, M.V.R., Mascarenhas, S.J., Nadaf, N.D. and Kunwar, R.A., 2020. Smart Kitchen System using IOT. *vol*, *4*, p.6.

[4] Macker, A., Shukla, A.K., Dey, S. and Agarwal, J., 2018, May. ARDUINO based LPG gas monitoring… automatic cylinder booking with alert system. In *2018 2nd International Conference on Trends in Electronics and Informatics (ICOEI)* (pp. 1209-1212). IEEE.

[5] Ahsan, Ali, Mohammad Zahirul Lslam, Rumali Siddiqua, and Md Khalilur Rhaman. "An IoT Based Interactive LPG Cylinder Monitoring System with Sensor Node Based Safety Protocol for Developing Countries." In *2020 IEEE Region 10 Symposium (TENSYMP)*, pp. 398-401. IEEE, 2020.

[6] Manikandan, T., Selvan, D.T., Vaidhyanathan, R., Vigneshvaran, B. and Nandalal, V., 2020. Home groceries management system using IoT. *International Journal of Psychosocial Rehabilitation*, *24*(05).

[7] Nugroho, Fibry, and A. B. Pantjawati. "Automation and monitoring smart kitchen based on Internet of Things (IoT)." In *IOP Conference Series: Materials Science and Engineering*, vol. 384, no. 1, p. 012007. IOP Publishing, 2018.

[8] Satyanarayana, K.N.V., Reddy, S.R.N., Varma, K.S. and Raju, P.K., 2017. Mobile app & iot based smart weather station. *International Journal of Electronics, Communication and Instrumentation Engineering Research and Development (IJECIERD)*, *7*(4), pp.1-8.

[9] Satyanarayana, K.N.V., Yaswanthini, G., Kartheeka, P.L., Rajkumar, N. and BhimaRaju, A., 2018. IoT based vehicle speed control automatically in restricted areas using RFID. *Int J Eng Technol*, *7*(3.31), pp.72-74.

[10] Satyanarayana, K.N.V., Reddy, S.R.N., Teja, P.S. and Habibuddin, M.B., 2016. IoT based smart weather station using Raspberry-PI3. *Journal of Chemical and Pharmaceutical Sciences*, *2016*(10), pp.1-6.