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Climate Change

Climate change is a clichéd phrase these days, but its use inevitably invokes a reaction. According to IPCC, the UN-based Intergovernmental Panel on Climate Change, some of the profound changes currently seen are permanent and never witnessed before. These include Global Warming, Polar Ice caps and glacier sheets melting, and ocean levels rising. According to existing data since pre-industrial times, the earth's climate has already warmed by over one degree Celsius; we are on track to continue this trend and further increase global temperatures by one and a half degrees Celsius in the next few decades. The consequences are already evident and unless immediate corrective action is taken, the results could be disastrous for humanity.

As we know, the main reason behind global warming is the enhancement of the earth's natural greenhouse effect by human activities. The most incriminating activity is fossil fuel burning, which releases large quantities of CO_2 to the atmosphere. Entrapment of other such greenhouse gases (GHG) in the atmosphere with warming potential like methane, nitrous oxide and fluorinated gases is accelerating the process. The 'sinks' including the atmosphere, rainforests, seas and oceans are overwhelmed with the billions of metric tons of such GHGs emitted every year, and a point of no-return is rapidly approaching.

What are the predictions if we continue this trend of discharging GHGs into the environment? According to current models, ocean levels will continue to rise, at around 30 - 50 cm per century, likely flooding and wiping out major coastal cities. Rising sea levels are both due to the polar ice caps and glaciers melting, along with the volume expansion of water with increasing temperatures. Hurricanes and tropical storm intensities and frequencies will also likely increase, as a direct correlation between the power of storms and global surface temperatures has been established by researchers. Changes in precipitation patterns, droughts and wildfires worldwide will also increase with global warming; the Arctic Ocean will become ice-free. And then, also lesser known but nevertheless as important, is that the arctic permafrost is noticeably declining. Permafrost is, by definition, ground that remains frozen for two or more years. Vast swathes of territory in the northern latitudes were historically home to permafrost; however, significant amounts of it have thawed, and will continue to release more trapped methane, further exacerbating the GHG emissions process.

So what are the solutions and a tangible way out of this mess we have created? A complete and total withdrawal from fossil-fuel based technologies, coupled with adequate sequestering techniques to recapture some of these GHGs would be a good start. Manufacturing process and power industries need to implement radical changes and incorporate renewable energy technologies en masse. We have demonstrated earlier that with the replacement of chlorofluorocarbons from refrigeration and air-conditioning units, the Ozone layer depletion has been almost completely reversed. There is no reason why we cannot step up to the plate and do it again with climate change, although this is a much more formidable task. We have few options left and an all-out blitz in tackling this problem is the need of the hour – when there is a will, there is a way!

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Design and Implementation of Multilevel Inverter for Photovoltaic Application

Abstract : A multilevel inverter is a power electronic device that is capable of providing desired alternating voltage level at the output using multiple lower-level DC voltages as an input. Generally, a two-level inverter is used in order to convert the DC voltage to AC voltage. Multilevel cascaded H-bridge inverters have high conversion efficiency and can easily be interfaced with renewable energy sources such as solar panels. Objective of this project is to design a photovoltaic module, in which the panel will be constructed by series and parallel connection of solar cells. A comparison between total harmonic distortions of voltage waveforms obtained from different level cascaded H-bridge inverter will be made using shifted pulses technique for switching. The DC Source required for multi-level inverter will be given from the boost converter, which generates multiple outputs. This paper is divided in two parts. In the first part, the simulation of a boost converter will be done which produces two outputs of the same voltage rating. Then the multilevel inverter is constructed using six switches, two sources. The converters will be simulated with help of MATLAB software.

Keywords: Cascaded H-bridge multilevel inverter (CHB), Multilevel inverter (MLI), Multilevel Boost converter, Total Harmonic Distortion (THD)

I. INTRODUCTION

Nowadays the amount of energy consumption is increasing drastically. The energy consumption rate is more in developing countries and the major part of the energy comes from fossil fuels. Energy obtained from fossil fuels will become extinct in a few years [1]. Therefore, there is a necessity to find an alternative source of energy that is renewable sources which are available at free of cost, do not harm the environment, and are inexhaustible. They are generally used for electricity generation, vehicles, and water pumping applications.

Over the last decade, energy demand from the power grid has increased significantly due to the increasing number of users and the emergence of high-power industries. Photovoltaic systems have become the most popular resources as their protential is enormous, thus, the worldwide installed PV capacity has increased to more than 635 gigawatts GW, covering approximately 2% of the global electricity demand doesn't actually helps the challenged person actually. With the increasing demand of energy, the focus is shifting towards the use of conventional sources. Solar energy is the most readily available form of energy. It is the most important form of non-conventional energy because it is nonpolluting and thus helps in reducing greenhouse effect. It is also free of cost. It can be harnessed and used for different purposes with help of solar panel. Solar panel can be constructed by series and parallel connection of solar cells. They produce electricity due to quantum mechanical process known as "photovoltaic effect".

II. PROPOSED METHOD

The output power of the PV cell is generally very low which doesn't satisfy the major and minor industrial requirements. The primary trouble faced by traditional inverters is that it generates only two-level output, high THD factor, and switching losses, suitable for a low power application, voltage stress is more on switches. The emerging multilevel inverter trends have to overcome harmonics, to obtain pure sinusoidal waveform [2]. The benefit of using MLI in a grid-connected PV system is that an additional transformer to boost the voltage is made redundant. For that reason, we connected the boost converter which will increase the output power by multiple times depending upon the duty cycle. Again, a multilevel inverter is used instead of regular single phase full bridge inverters which will convert the DC voltage to AC. This AC voltage is more sinusoidal and less harmonically distorted than the single-phase full bridge inverter.

III. CHARACTERISTICS OF PV CELL

In a PV characteristic there are basically three important points viz. open circuit voltage, short circuit current and maximum power point [3]. The maximum power that can be extracted from a PV cell are at the maximum power points.
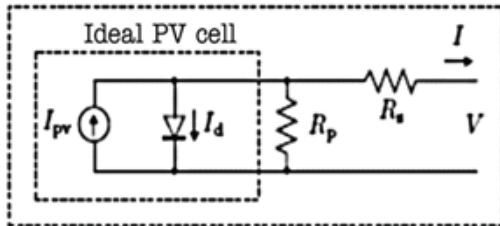
Fig 1. Single-diode model

The ideal photovoltaic cell is represented in Fig. 1 as equivalent circuit model. The basic equation from the theoretical operation of semiconductors that mathematically describes the I- V characteristic of the ideal photovoltaic cell is in the following equation.

$$I = I_{PV,cell} - I_{0,cell}\left[\exp\left(\frac{qV}{akT}\right) - 1\right]$$

where Ipv, cell is the current generated by the irradiation of sun light, Id is the Shock ley diode equation, I0, cell is the reverse saturation or leakage current of the diode, q is the charge of an electron [1.60217646x10−19C], k is the Boltzmann constant [1.3806503x10−23J/K], T is the temperature of the p-n junction in Kelvin, and a is the diode ideality constant.
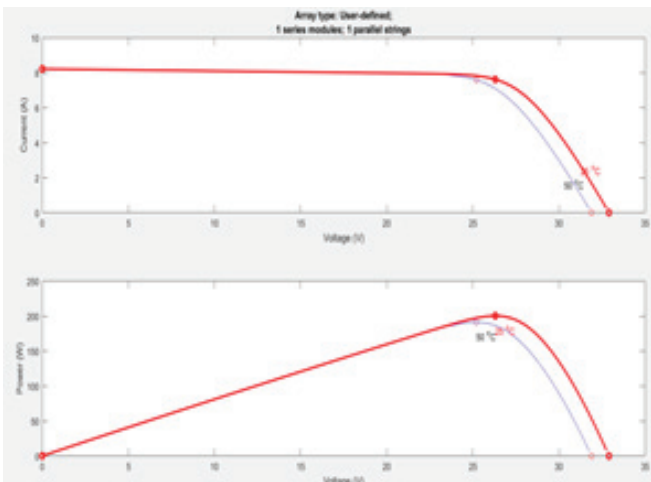
Case 1: With varying temperature

Fig.2 I-VandP-Vcurvewithvarying temperature
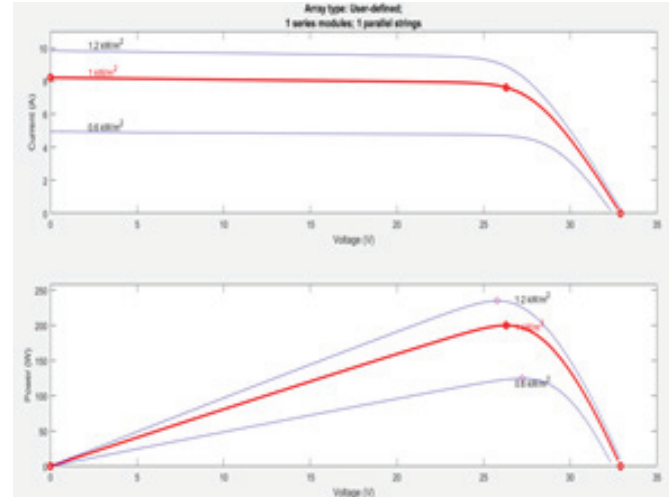
Case2: With varying irradiance

Fig. 3 I-V and P-V curve with varying irradiance

So, as the temperature increases, due to environmental changes or heat generated by internal power dissipation during energy production, the open circuit voltage (Voc) decreases.This in turn reduces the power output. In a solar cell, the parameter most affected by an increase in temperature is the open-circuit voltage

In the same way, irradiance will also affect the module performance, with a reduction of sunlight resulting primarily in a reduction in current and consequentially a reduced power output.

IV. MAXIMUM POWER POINT TRACKING

MPPT or Maximum Power Point Tracking is a special technology that you can apply to produce better power output from turbines and PV solar modules in various circumstances. MPPT controller can detect in real time the generated voltage of solar panels and track the maximum voltage and current values (the VI), so that the system could charge the battery with the maximum power output. MPPT can be applied in photovoltaic inverter to coordinate with solar panels, batteries and workloads.

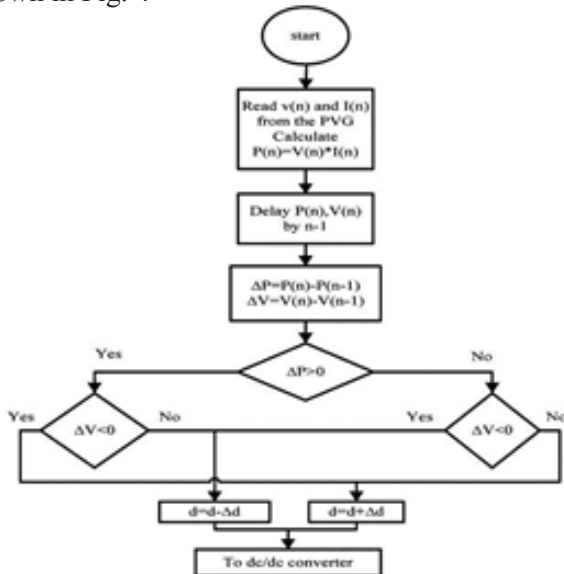The flowchart for Duty cycle calculation in MPPT is shown in Fig. 4

Fig. 4Flowchart for duty cycle calculation in MPPT

MPPT controller generates duty cycle in order to create switching signals for the converter. The switching signal allows the boost converter to operate the solar PV system at optimum voltage and current so that the maximum power extraction is possible [4,5].

Working of MPPT

When charging for the battery, the solar panel output voltage must be higher than the current battery voltage, if the solar panel voltage is lower than battery voltage, the output current would be close to 0. So, for safety, the solar panel peak voltage (Vpp) would be set at about 17V, which is set based on the ambient temperature of 25 °C. When the weather is very hot, the solar panel peak voltage (Vpp) would fall to about 15V, but in cold weather, the solar peak voltage (Vpp) can reach 18V.

The charging parameters are set at factory default for MPPT solar pumping controller, that is, MPPT controller would track the maximum power point of solar panels in real-time to realize the best effect of solar panels. The higher the voltage, through max power point tracking, more power would be outputted, thereby improving the charging efficiency.

V. BOOST CONVERTER

Boost Converters as shown in Fig.5, also known as step-up choppers are the type of chopper circuits that provides such an output voltage that is more than the supplied input voltage. In the case of boost converters, the DC-to-DC conversion takes place in a way that the circuit provides a high magnitude of output voltage than the magnitude of the supply input.
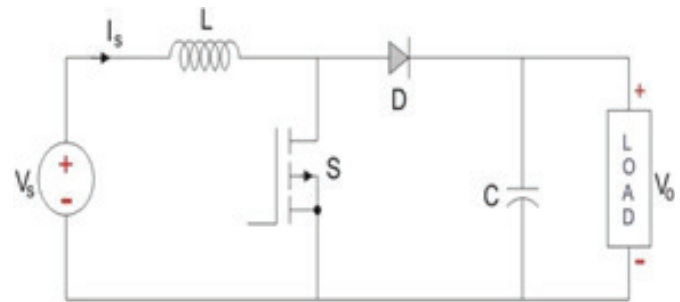

Fig.5 ElementaryCircuitofBoostConverter

Operating Principle

Initially, when the chopper is in on state as in Fig. 6, then in the presence of supply dc input current begins to flow through the closed path of the circuit i.e., passing through the inductor as shown in the figure below
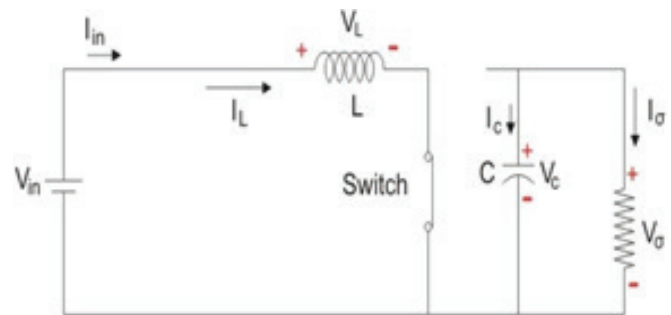

Fig. 6. Boost Converter when Switch is ON, Diode is OFF

Fig.6 Boost Converter when Switch is OFF, Diode is ON

The output waveform of boost converter will be like the figure 7 below.

Fig.7 Output waveform for Boost Converter with MPPT
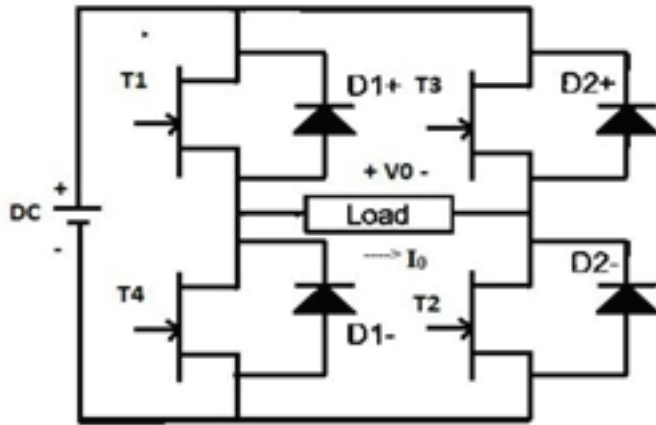
VI. FULL BRIDGE INVERTER

Fig. 8 single phase inverter

A full bridge single phase inverter shown in Fig. 8, is a switching device that generates a square wave AC output voltage on the application of DC input by adjusting the switch turning ON and OFF based on the appropriate switching sequence, where the output voltage generated is of the form +Vdc, - Vdc, Or 0.

The construction of full-bridge inverter consists of 4 choppers where each chopper consists of a pair of a transistor or a thyristor and a diode, pair connected together that isT1 and D1 are connected in parallel, T4 and D2 are connected in parallel,T3 and D3 are connected in parallel, and T2 and D4 are connected in parallel.A load V0 is connected between the pair of choppers at "AB" and the end terminals of T1 and T4 are connected to voltage source VDC as shown below [6].

VII. MULTI LEVEL INVERTER

Some of the industrial loads require low and medium power requirement. Using a high-power source to all the loads may be beneficial for higher power applications but will damage other low and medium power equipment. Sources like batteries, super capacitors, solar panel are medium voltage sources. The multilevel inverter consists of several switches and consists of various levels to increase the power as per the requirement. Multilevel inverters are the preferred choice in industry for the applications in high voltage and high-power application.

The circuit of a five levels inverter is shown in Fig. 9 below which consists of a full bridge inverter, an auxiliary circuit and two voltage dividing capacitors. The auxiliary circuit mainly generates half level DC

voltage. The switching conditions for five output voltage levels were tabulated in Table 1. The switching in the auxiliary circuit is determined by the direction of load current [7, 8].
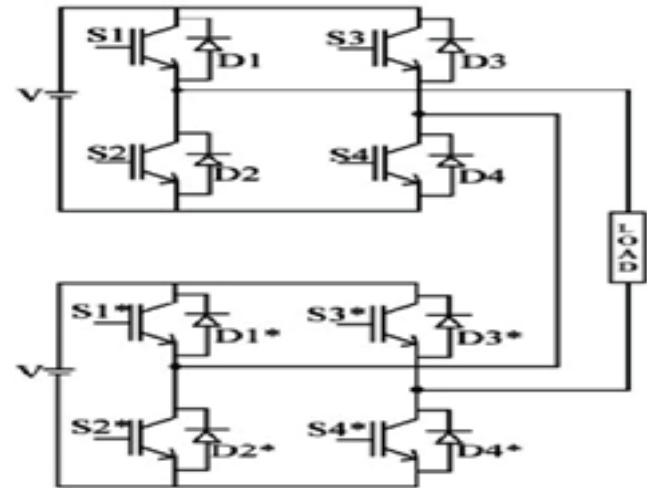

Fig.9 Circuit of a five-level multilevel inverter
Table 1Five level multilevel inverter switching

Switching Sequences								Voltage levels
S_1	S_2	S_3	S_4	S_5	S_6	S_7	S_8	
1	1	0	0	1	1	0	0	$+2V_{dc}$
1	1	0	0	0	0	0	0	$+1V_{dc}$
0	0	0	0	0	0	0	0	$0V_{dc}$
0	0	1	1	0	0	0	0	$-1V_{dc}$
0	0	1	1	0	0	1	1	$-2V_{dc}$

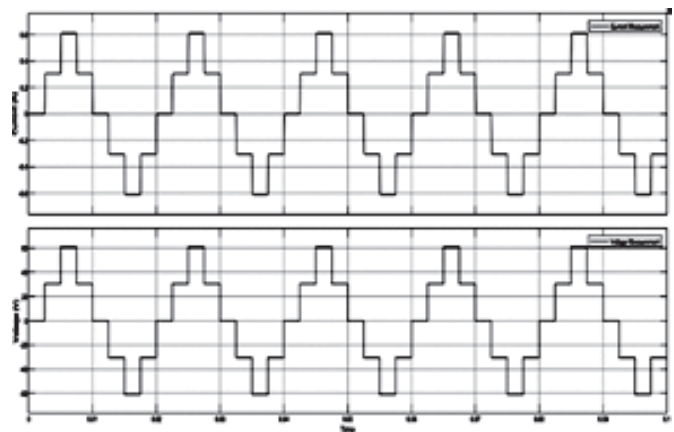The output waveform of five level multilevel inverter is shown in Fig. 10

Fig.10 Output waveform of five level multilevel inverter

VIII. COMPARISON

The waveform in fig. 11 shows the output of the full bridge inverter with boost converter and the waveform have been magnified 2 times in comparison to the full bridge inverter without boost converter. So, with the help of boost converter we can increase the voltage level as for the suitable requirement.
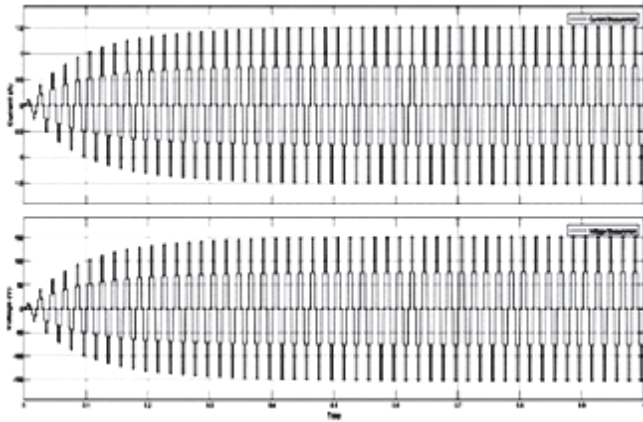

Fig. 11 Output/Waveform of Simulink Model of a conventional PV module and boost converter with 5-Level Multilevel inverter

The waveform in fig. 12 shows the output of the 5-level inverter with boost converter and the waveform have been magnified 2.5 times in comparison to the 5-level inverter without boost converter. So, with the help of boost converter we can increase the voltage level as for the suitable requirement.

The converter is operated in CCM (continuous conduction mode) and its output waveform is as shown in Fig. 5.4. This converter generates a dual output voltage of the same voltage ratings (V01 and V02=75V). The output waveforms of the inverter are shown in Fig. 13. The output voltage waveform has five levels of (0V, 75V, 150V, -75V, -150V). The output current is as shown in Fig. Fig. 13. The output current measured is 1.5 A peak.
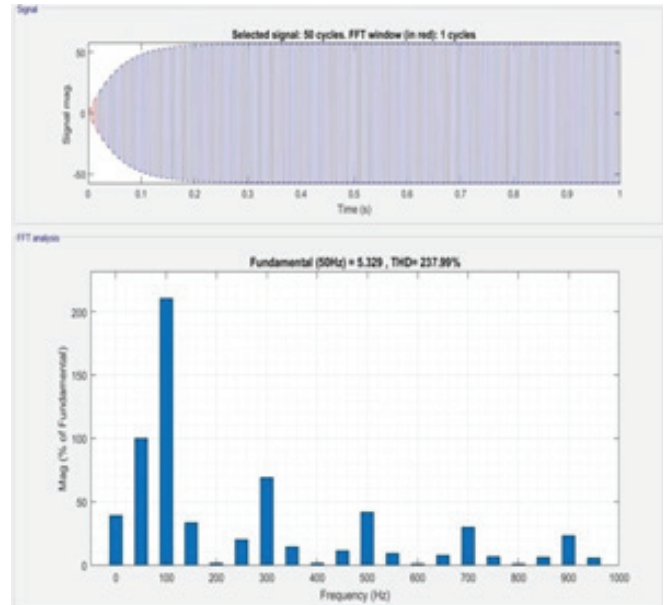
THD Comparison

Fig. 12 Output waveforms and corresponding THD analysis of Full Bridge inverter
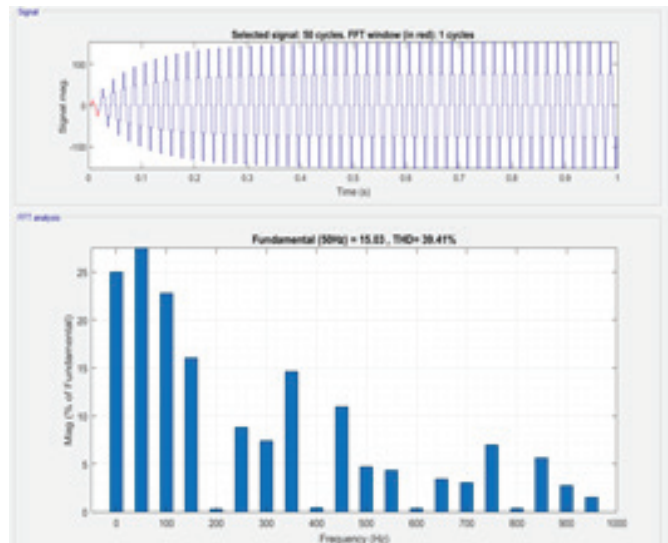

Fig. 13 Output waveforms and corresponding THD analysis of 5- Level Multilevel inverter

Fig. 13 represents the THD (Total Harmonic Distortion Factor) value of the Full Bridge Inverter i.e., 237.99%. And the Fig. 5.6 represents the THD (Total Harmonic Distortion Factor) value of the 5-Level Multilevel Inverter i.e., 39.41%. So, with the help of multilevel inverters we can reduce the Harmonic Distortion of the circuit.Hence, by introducing both boost converter and multilevel inverter we can increase the magnitude of power while reducing the harmonic distortion.

IX. CONCLUSIONS

Solar panel output is boosted by dual stage boost converter and cascaded H-bridge inverters are used to convert DC output of boost converter to AC. Single-phase MLI for standalone PV system application was projected. The number of switches and PWM pulse generation and THD value of projected 5- level inverter was better than convention inverter (full bridge) topologies. In addition, the complexity of cascaded inverter topology is reduced along with the cost. The output voltage of the 5-level inverter converter is 0V, 75V, 150V, -75V, -150V. The simulation results validate the feasibility of the converter.

X. FUTURE SCOPE

There is always scope of improvement and there is lot more that can be done to make this more convenient and feasible for the future. Some of the future scope we are looking forward to work into are:

• Closed loop analysis can be done by designing various linear and non-linear controllers

• We can also use higher level of multi-level inverters which will decrease the THD.

• The analysis of overall system can be done using partial shading effects.

REFRENCES

[1] A. Iqbal, S. Gore and P. K. Maroti, "Single Phase Multilevel Inverter for Standalone PV system Application," IECON 2020 The 46th Annual Conference of the IEEE Industrial Electronics Society, 2020, pp. 3313-3317, doi : 10.1109/ IECON43393.2020.9255122.

[2] Guo, Xiao-Qiang & He, Ran & Narimani, Mehdi. (2016). Modeling and Analysis of New Multilevel Inverter for Solar Photovoltaic Power Plant. International Journal of Photoenergy. 2016. 1-8. 10.1155/2016/4063167.

[3] S. Banerjee, P. Kumari and R. Kumar, "Design and implementation of photovoltaic module using multilevel inverter and boost converter" for IRJET, Academia.edu, Academia, Nov- (2017)-35376291

[4] Swathy, S. & Niveditha, N. & Mauryan, K. S. Chandragupta. (2020). Design of Five-Level Cascaded H-Bridge Multilevel Inverter. 10.1007/978-981-15-2256-7_7.

[5] N. Priyadarshi, S. Padmanaban, P. Kiran Maroti and A. Sharma, "An Extensive Practical Investigation of FPSO-Based MPPT for Grid Integrated PV System Under Variable Operating Conditions with Anti-Islanding Protection," in IEEE Systems Journal, vol. 13, no. 2, pp. 1861- 1871, June 2019.

[6] S. M. Cherati, N. A. Azli, S. M. Ayob and A. Mortezaei, "Design of a current mode PI controller for a single-phase PWM inverter," 2011 IEEE Applied Power Electronics Colloquium (IAPEC), 2011, pp. 180-184, doi: 10.1109/ IAPEC.2011.5779864.

[7] Vinesh Kapadia and Dr. Hina Chandwani, "comparison of modulation techniques for cascaded H-bridge type multilevel current source inverter", 2013

[8] S. K. Singh and A. Haque, "Performance evaluation of MPPT using boost converters for solar photovoltaic system," 2015 Annual IEEE India Conference (INDICON), 2015, pp. 1-6, doi: 10.1109/INDICON.2015.7443516

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Anna Mani

One of India's pioneering women scientists, Anna Mani marked her presence in 1918 at Peermade, then Travancore, now Kerela to a Syrian Christian family. Mani was the former Deputy Director General of the Indian Meteorological Department and made notable contributions in the field of solar radiation, ozone and wind energy instrumentation, hence winning the title of the Weather Woman of India. Mani's formative years were highly engrossed in books which directed her to new ideas and made a prominent effect in her a deep sense of social justice and shaped her future. Impressed by Gandhian Principles and inspired by him, she chose to wear only khadi garments as a symbol of her nationalist sympathies. Mani wanted to pursue her career in dancing but rather chose to study physics as she had interest in the subject. Her strong belief in nationalism instigated a fierce desire for personal freedom and studying further rather than following the footsteps of her sisters. Mani graduated in 1939 from Pachaiyappas College with a Honours degree in physics and chemistry subsequently in 1945 she went to Imperial College, London to graduate in physics but ended up doing it in meteorological instruments. Mani then started her research career at the Indian Institute of Science, Bengaluru under the supervision of Prof. C.V Raman. She started her work on the spectroscopy of diamonds and rubies. Mani joined the Indian Meteorological Department, Pune. She standardized the drawings of about hundred weather instruments as she wished to make India independent in making weather instruments. In 1960, Mani started her work in measuring atmospheric ozone and then setting up a meteorological observatory at the Thumba rocket launching facility. She was amalgamated with various scientific organizations and she was also a recipient at INSA K. R. Ramanathan Medal. In 1976, she retired as deputy director general of the meteorological department and later did set up a millimetre-wave telescope at Nandi Hills, near the city. Mani never married and suffered a stroke and breathed her last on 16 August 2001, just a week before her 83rd birth anniversary.

"Wrong measurements are worse than no measurements at all."

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Smart Health Monitoring System

Abstract: Healthcare technology was very popular during the pandemic. Actually, health care technology has been rapidly revolutionized with the help of IoT. Monitoring the health status of a covid patient is a hard task because of our busy schedules. Mostly, the elderly patients should be monitored periodically. So, we thought of a system to automate this task. This device uses an ESP32 web server to track patient health using this monitoring system. Hence, patient health parameters such as body temperature, heart rate as well as room temperature, and humidity can be monitored from any device (like Smartphone, Laptop, etc.) that supports browsing capabilities. Further data's will be stored in database and will perform future predictions.

In this study we showcase an ESP32-based Patient Health Monitoring System which will measure Heart Rate using KY-039 pulse sensor and body temperature using DS18B20 temperature sensor. Meanwhile, the patient is inside the room. So, we need to monitor room temperature and humidity levels as well. We should keep them in a room with a certain temperature and humidity level to not feel uncomfortable. Hence, we have used a DHT11 Temperature & Humidity sensor.

Keywords: IoT; ESP32; HMS; DS18B20; DHT11; Body Temperature; Heart Rate; KY039

I. INTRODUCTION

More recently, the covid-19 epidemic has been one of the major global problems facing health organizations. Affected patients had a few symptoms among which were high fever, low oxygen levels, and irregular heart rate were considered serious as these symptoms could cause other problems such as hypoxia and hypoxemia which would reduce the patient's chances of survival. Sometimes, patients are unaware of these problems and are therefore unable to get proper treatment before it is too late. Therefore, it is important that covid-19 patients be monitored regularly and informed of their health status especially body temperature, heart rate, and oxygen saturation (SpO2). As a person gets older, he or she will need to check his or her health regularly during such traumatic events. As this process can be time consuming for many people to get appointments for health check-ups so an IoT-based health monitoring system can be helpful for individuals to get regular health check-ups.

IoT technology has been developed into something new for use in various environments. In particular, it refers to any system of portable devices that receive and exchange information on wireless systems without human involvement. With the significant growth in the working population of COVID-19, each country faces challenges in providing appropriate care to its patients.

Heart rate and body temperature are fundamental aspects of human health. Heart rate is the number of pulses per minute. Typical heart rate ranges from 60 beats to 100 beats per minute per person. The heart rate between older men and women is about 70 and 75 bpm, respectively. Women 12 years of age or older usually have higher heart rates than men. However, the heart rate of patients affected by COVID-19 is uncommon and requires help from a medical assistant. A person's internal temperature depends on many factors, such as gender, diet pattern, and ambient temperature. The internal temperature is between 36.5° C and 37.2° C for healthy adults. Many factors, such as low-temperature hypothermia, the flu, and other illnesses, can cause body temperature fluctuations. In many patients infected with COVID-19, fever is a common symptom; therefore, it is necessary to measure their body temperature regularly. SpO2 is also an important factor in COVID-19-affected patients. The average human SpO2 ranges from 95 to 10 percent. If the SpO2 level of a patient affected by COVID-19 is less than 95 percent they need immediate testing. Corona virus can cause silent hypoxia, i.e., SpO2 in less than

90 percent without dehydration. If the SpO2 level of a patient exposed to COVID-19 is as a result, it can lead to death. Silent hypoxia can be detected by monitoring SpO2 using a pulse oximeter. To control COVID-19, it is important to check early symptoms such as cough, fever, heartbeat, and SpO2.

Advantages of SHM system

- Remote monitoring
- Earlier and better diagnoses
- Cheap & user friendly
- Suitable for Rural Areas
- Improves patients' lifestyle
- Saves money

Disadvantages of SHM system

- Accuracy of Low-cost Sensor
- Risk of failure
- Security and privacy
- Doubtful reliability

II. LITERATURE REVIEW

In the article reported by Paolo Bellavista, et al. (2016), an innovative distributed architecture combining machine-to-machine industry-mature protocols (i.e., MQTT and CoAP) in an original way to enhance the scalability of gateways for the efficient IoT-cloud integration was proposed [1].

In the article by Nguyen Quoc Uy, et al. (2020), a comparison of AMQP and MQTT protocols for the Internet of Things" and ease of MQTT protocols the for smooth working of the king of internet of things industry was proposed [2].

In the article reported by Rupali Kiran Shinde, et al. (2022), importance of health monitoring systems and improvement of effectiveness in the monitoring system to enhance the healthcare industry's role in upcoming innovations was proposed [3].

In the article reported by V. Pravalika, et al. (2020),a control system using ESP32, with IP connectivity through local Wi-Fi for accessing and controlling devices they formal user remotely using the web application and Technology to store the data we collect, use of various IoT communication protocols (MQTT) and to present advantages of the widespread IBM-developed Node-RED was proposed [4].

In the article reported by Balakumar Balasingam, et al. (2020), we took the approach to robust battery management consisting of accurate characterization, robust estimation of battery states and parameters, and optimal battery control state [5].

In the article reported by Miron zapciu et al. (2021), designed of a single layer PCB is created using Easy Edaand pin headers are used to minimize soldering and make it damage proof.Also, Integration and design of PCB in cost effective way[6].

In the article reported by Md. Milon Islam et al. (2020), five sensors are used to capture the data from hospital environment. CO & CO_2 Sensor are used for air quality control system & measurement of toxic gases in room environment [7].

III. EQUIPMENT USED

Sl No.	Components Used	Quantity	Description
1.	ESP 32	02	SoC micro- controller with integrated Wi-Fi and dual-mode Bluetooth.
2.	DHT 11	01	Ultra low-cost digital temperature and humidity sensor.
3.	DS18B20	01	Direct-to- digital temperature sensor
4.	Pulse Rate Sensor	01	Use to measure Heart Rate
5.	Vero board	02	Simple PCB where we build circuits by soldering components.
6.	9v Battery	01	9V Non- Rechargeable Battery with Constant 9V Output.

7.	Lithium-Ion Battery	01	Rechargeable battery with Cell Voltage 3.7V & Capacity 2200mAh
8.	TP4056	01	1A Li-Ion Lithium Battery charging Module
9.	DC-DC Boost Module	01	DC-DC Boost Module (0.9V~5V) to 5V 600MA USB Step-up Board. Provides 5V Output
10.	LM7805	01	Used to provide a constant output voltage of 5V

IV. METHODOLOGY

IoT technology has been developed into innovation with applications in various areas. Mainly, it refers to any system of physical devices that obtain and exchange information over wireless systems without human involvement. With a significant increase in the number of active COVID-19 cases, every country faced issues in providing proper treatment to their patients.

Pulse rate and body temperature are the basic elements of human health. The pulse rate is the number of pulses per minute. The normal pulse rate ranges between 60 and 100 beats per minute for an individual. The average resting pulse rate for adult males and females is approximately 70 and 75 bpm, respectively. Females of age 12 or more usually have higher pulse rates as compared to men. However, the pulse rate of COVID-19 affected patients is abnormal and requires help from a medical assistant. The internal heat level of an individual depends upon many elements, such as gender, dietary pattern, and surrounding temperature. The internal heat level ranges between 36.5° C and 37.2° C in healthy adult human beings. Numerous factors, such as low-temperature hypothermia, Influenza, and other diseases, can cause a fluctuation in body temperature. In most COVID-19 affected patients, fever is a common symptom; therefore, it is necessary to routinely measure their body temperature. Fig. 1 shows the flow of health monitoring system & Fig. 2 shows the block diagram of the device.
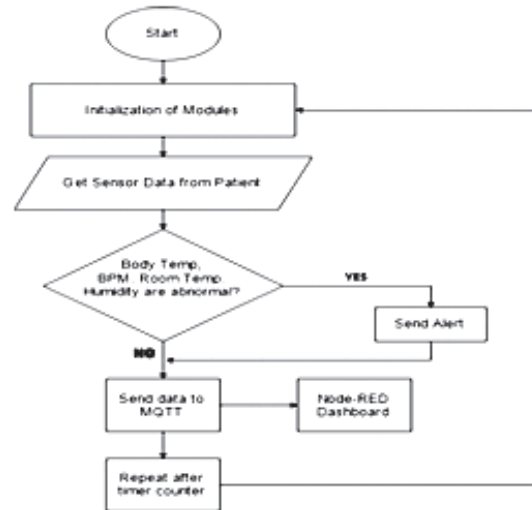

Fig-1.Flow chart for health monitoring system
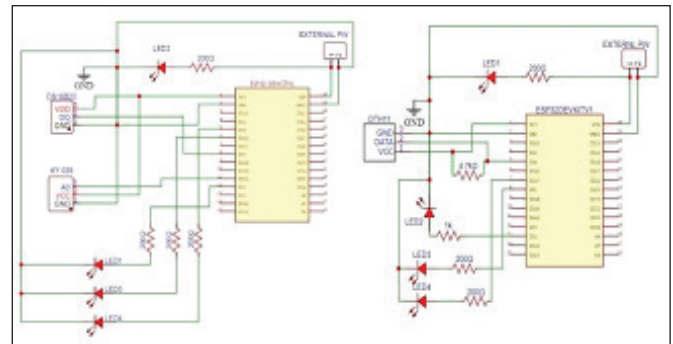
V. SCHEMATIC

Fig-2. showing schematic of both Wearable & Wall Mount Device respectively

VI. BLOCK DIAGRAM

- For Wall Mount Device

The block diagram shown in Fig-3 has shown how the esp32-based wall mount device works in our study. There is a DHT11 sensor that measures the room temperature of the patient's room. The data i.e., the room temperature collected by the sensor is then sent to esp32 based wall mount device which is connected to a power supply. The esp32-based wall mount device acts as an MQTT client and sends the data to the node-red which is acting as an MQTT broker. The node-red collects the data. This collected data is shown in the dashboard in form of tables and graphs. This data is further sent to the database through a PHP server which is again an MQTT client. This whole process is carried out within the range of a local Wi-Fi router.

Fig-3. Block Diagram

•   For Wearable Device

The block diagram shown in Fig-4 has shown how the esp32-based wearable device works in our project. There are KY 039 Sensor & DS18b20 sensors that measure the heart rate and body temperature of the patient's room. The data i.e., the room temperature collected by the sensor is then sent to esp32 based wearable device which is connected to a power supply that is managed by a battery management system. The esp32-based wearable device acts as an MQTT client and sends the data to node-red which is acting as an MQTT broker. The node-red collects the data. This collected data is shown in the dashboard in form of tables and graphs. This data is further sent to the database through a PHP server which is again an MQTT client. This whole process is carried out within the range of a local Wi-Fi router.
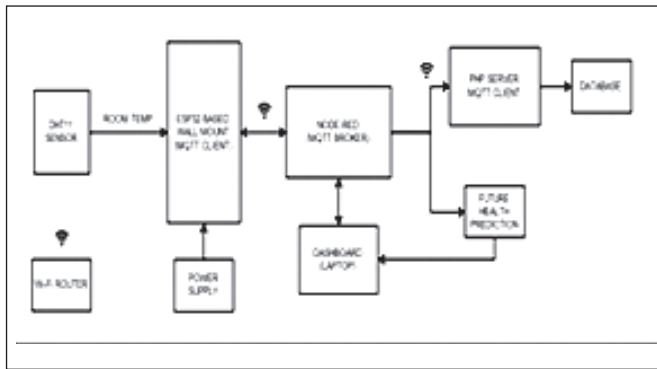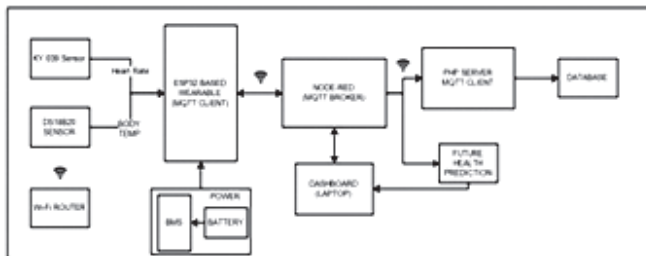

Fig-4. Block Diagram

VII. RESULTS & ANALYSIS

The prototype consisting of an esp32-based wearable device and wall mount device work in our project. There are KY 039 Sensor & DS18b20 sensors that measure the heart rate and body temperature of the patient's room. There is a DHT11 sensor that measures the room temperature of the patient's room.

Data Visualization Dashboard

To confirm the successful working of our prototype of the smart health monitoring system we have tested the prototype on five different subjects in five different conditions and the result shown is for one of the test subjects and it is being represented inform of graphs for easy understanding and visualization. Figure- 5 shows the representation of the data in dashboard.

Fig-5. Representation of data in the dashboard

Figure-6 showing the variation of BPM with time for two different persons using KY-039 sensor.
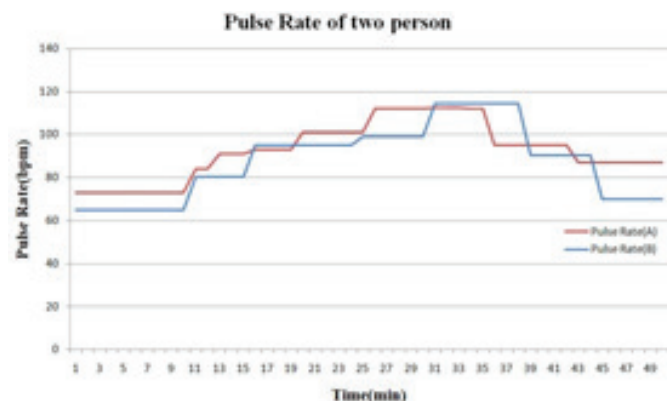

Figure 6: Variation of BPM with Time

Figure-7: showing the variation of body temperature with time using DS18b20 sensor.
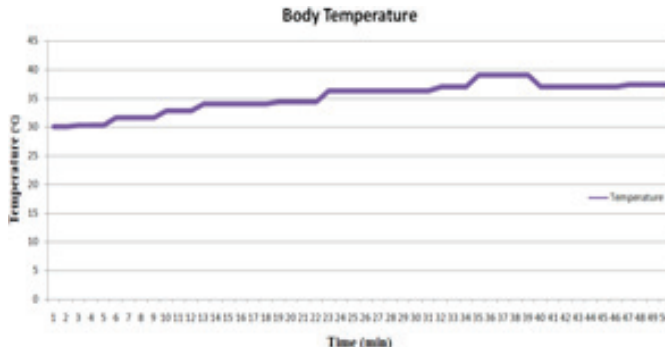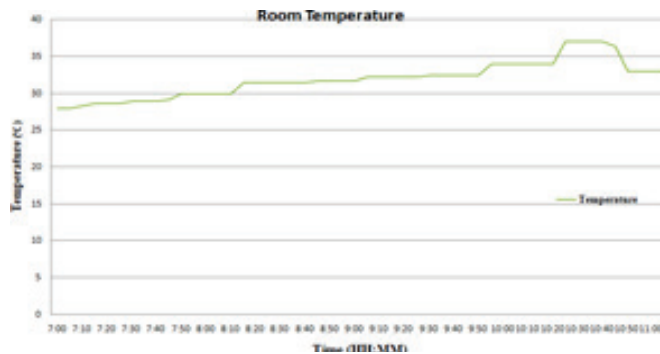

Figure 7: Variation of Body Temperature with Time

Figure 8: Variation of Room Temperature with Time

Figure 9: Variation of Room Humidity with Time

Figure-8 & 9 show the variation of room temperature and room humidity with time using DHT11 sensor.

VIII. CONCLUSIONS

The future of IoT has a greater opportunity to make a positive impact on the healthcare industry. The Internet of Things is considered now as one of the feasible solutions for any remote value tracking especially in the field of health monitoring. This IoT-based device allows users to determine their health parameters, which could help regulate their health over time. Eventually, the patients could seek medical assistance if the need arises. The system will measure a patient's body temperature and pulse rate along with it a wall mount device which will detect room temperature and humidity and will send data to MQTT.

Finally we can display our data in Node Red Application. The system is cost-effective, noninvasive, and versatile in nature, which makes it easier to screen patients' well-being regardless of where they are. Therefore, to make all lives risk-free, we must use smart health monitoring systems. To conclude, this system is extremely important in the medical sector because it can help increase the life expectancy of people worldwide. In the future, more sensors can be added to this system to monitor more physiological parameters of the human body.

IX. FUTURE SCOPE

• More sensors can be added to get more parameters.

• Other diseases can also be predicted by using different data sets

• GPS module can be added so that doctors can track the location of the patient and take the necessary actions when needed.

• Smart cameras can be used for monitoring elderly patients.

• Using chip instead of Development board in Wearables.

• Using Multi-Layer Circuit Boards to make PCB compact.

REFERENCES

[1] Paolo Bellavistaand Alessandro Zanni, " Towards better scalability for IoT-cloud interactions via combined exploitation of MQTT and CoAP" IEEE 2016

[2] Nguyen Quoc Uy, Vu Hoai Nam, " A comparison of AMQP and MQTT protocols for Internet of Things" IEEE 05 March 2020

[3] Rupali Kiran Shinde; Md Shahinur Alam; Seong Gyoon Park; Sang Myeong Park; Nam Kim, " Intelligent IoT (IIoT) Device to Identifying Suspected COVID-19 Infections Using Sensor Fusion Algorithm and Real- Time Mask Detection Based on the Enhanced MobileNetV2 Model", doi: 10.3390/healthcare10030454.

[4] V. Pravalika & Ch. Rajendra Prasad, "Using Node-RED platform in an industrial environment" Jubileumi Kandó Konferencia 2020.

[5] Balakumar Balasingam; Mostafa Ahmed and Krishna R. Pattipati, "Battery Management Systems—Challenges and Some Solutions" Electric Systems for Transportation 2020.

[6] Sorin Burducea & Miron Zapciu. "PCB design of a servo motor controller under strict cost constraints – thermal aware component layout"

[7] Md. Milon Islam; Ashikur Rahaman & Md. Rashedul Islam, "Development of Smart Healthcare Monitoring System in IoT Environment" Article number: 185 (2020).

[8] "Real-world heart rate norms in the Health eHeart study", Robert Avram; Geoffrey H. Tison; Kirstin Aschbacher; Peter Kuhar et al. (2019).

[9] S.M. Riazulislam; Daehankwak et al. (2015), "The Internet of Things for Health Care: A Comprehensive Survey". In: IEEE Access (2015).

[10] Body temperature monitoring based on telemedicine", H R Fajrin et al 2019 J. Phys.: Conf. Ser. 1381.

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Cloud-Based Smart Traffic Management System

Abstract: *The main goal of the research is to make traffic management system work efficiently using Internet of Things, Infrared sensor and cloud computing in order to make traffic system work dynamically. Traffic management automation systems in the market aims to computerized the traffic lights operates on the periodic to control the light (red / green) uses various technologies like GSM (Global system for Mobile communication), NFC (Near-Field communication) focuses on the basic operation of an electrical switch.*

We plan on implementing the project for one junction "proof-of-concept", which includes traffic lights, IR- sensors, Wi-Fi transmitter. The sensed data that is collected from IR sensor is transmitted by the Wi-Fi transmitter. Based on this compilation it dynamically shifts time of the red signal and user gets a notification of status of the signal on his way. The collected data from sensors is stored in the cloud which provides way to ambulance and other vehicles.

Keywords: *Cloud Computing, Internet of Thing(IOT), Traffic Lights, Automated*

I. INTRODUCTION

This The Smart Transportation System domain includes the advanced Traffic Management System as a primary subfield. The Advanced Traffic Management System view is a top-down management with a perspective that integrates technology primarily to improve the flow of vehicle traffic and improve safety. Real-time traffic data from cameras, speed sensors, etc. flows into a Transportation Management Center from where it is integrated and processed (e.g. for incident detection) and may result in the following actions taken (e.g. traffic routing, DMS messages) to improve the overall traffic flow. The following primary goals and metrics for the Smart Transportation System is defined by The National Intelligent Transportation System Architecture.[1]

To manage highway traffic an integrated solution is put forward called Advanced Traffic Management system. It manages the issues through real- time information collection, processing, analysis, and finally dissemination to the users, concerned agencies, and stakeholders. Prime importance is given to providing real-time and precise information to users about the road condition, traffic situations, incidents, and weather conditions on the roadway to keep a check on the happenings all day all night. It is also important to make arrangements for smooth, safe, and efficient traffic movement by providing rescue and relief to the users to avoid anxiety and stress.

II. SYSTEM DESIGN

Intelligent urban traffic management system based on cloud computing and internet of things. The project consists of mainly six phases in the initial stage we gone gather the vehicle density information using the IR sensor for every 10 seconds then the sensors data transmit to the Google cloud using real-time database bucket id in the Google cloud traffic. Density is updated as signal1, signal2, signal3, and signal4. It has child density below that node the traffic density information is updated in this experiment we mainly consider three cases they are loose, moderate, and congested.[2]

A. Cloud Computing

Cloud computing is a kind of calculation mode which based on the Internet and Shared resources through the virtualization way. Its storage and computing resources

can be on-demand dynamically deployed, dynamically optimized and dynamically recalled. The basic principle of cloud computing is simplifying the client, only responsible for data input and read, and send complex dispose work to "clouds" to deal with. "Clouds" is the networking computer group and data center. Cloud computing realizes virtualization, instant customizing, facing the field, and flexible mutual combination by changing a series of innovative technology based on the Internet to service, such as storage, calculation, software, management, network, information and other kinds of resources.[3]

B. Internet of Things(IOT)

The Internet of Things (IoT) describes the network of physical objects—"things"—that are embedded with sensors, software, and other technologies for the purpose of connecting and exchanging data with other devices and systems over the internet. IoT involves extending Internet connectivity beyond standard devices, such as desktops, laptops, smart phones, and tablets, to any range of traditionally dumb or non-internet enabled physical devices and everyday objects. Embedded with technology, these devices can communicate and interact over the Internet, and they can be remotely monitored and controlled. With the arrival of driverless vehicles, a branch of IoT, i.e. the Internet of Vehicles starts to gain more attention.

III. SYSTEM ARCHITECTURE

Before The module thus implements Density based traffic controlling system using IR technology. PIC is a very efficient architecture used for low-end security systems and IR technology is widely adapted technology for communication. Current work focuses on the effective usage of IR and PIC controller for digital security systems.[4]

A. Abbreviations and Acronyms

GIS (Geographic Information System)

IoT (Internet of Things)

IR sensors(Infrared sensors)

NodeMCU(Node MicroController Unit)

PIC(Peripheral Interface Controller)

B. Hardware Requirements

i. Arduino uno

Arduino UNO is a low-cost, flexible, and easy-to-use programmable open-source microcontroller board that can be integrated into a variety of electronic projects. This board can be interfaced with other Arduino boards, Arduino shields, Raspberry Pi boards and can control relays, LEDs, servos, and motors as an output. The Arduino Uno is an open-source microcontroller board based on the Microchip AT mega 328P micro controller and developed by Arduino.cc. The board is equipped with sets of digital and analog input/output (I/O) pins that may be interfaced to various expansion boards (shields) and other circuits. (referred to as a microcontroller) and a ready-made software called Arduino IDE (Integrated Development Environment), which is used to write and upload the computer code to the physical board.[5]

ii. NodeMCU (WIFI MODULE)

NodeMCU is an open source development board and firmware based in the widely used ESP8266 -12E Wi-Fi module. It allows you to program the ESP8266 Wi-Fi module with the simple and powerful LUA programming language or Arduino IDE. The device is especially useful for IoT applications, thanks to its tiny footprint and built-in Wi- Fi support. NodeMCU is an open source platform based on ESP8266 which can connect objects and let data transfer using the Wi-Fi protocol. In addition, by providing some of the most important features of microcontrollers such as GPIO, PWM, ADC, and etc, it can solve many of the project's needs alone.

iii. IR sensors

An infrared (IR) sensor is an electronic device that measures and detects infrared radiation in its surrounding environment. An IR sensor can measure the heat of an object as well as detects the motion. These types of sensors measure only infrared radiation, rather than emitting it that is called a passive IR sensor.

C. Software Requirements

i. The Firebase Cloud Platform

Firebase is for simple projects or developing small features that require real-time data. When you create a Firebase project, you are actually creating a Google Cloud project behind the scenes. This means that you can view and manage many aspects of your Firebase project in the Cloud console. Cloud Storage for Firebase is a powerful, simple, and cost- effective object storage service built for Google scale.

ii. Arduino 1.8.19

The open-source Arduino Software (IDE) makes it easy to write code and upload it to the board. This software can be used with any Arduino board. The universal languages for Arduino include C and C++. So the application is meant mostly for developers and coders in those two languages.

D.   Flow chart
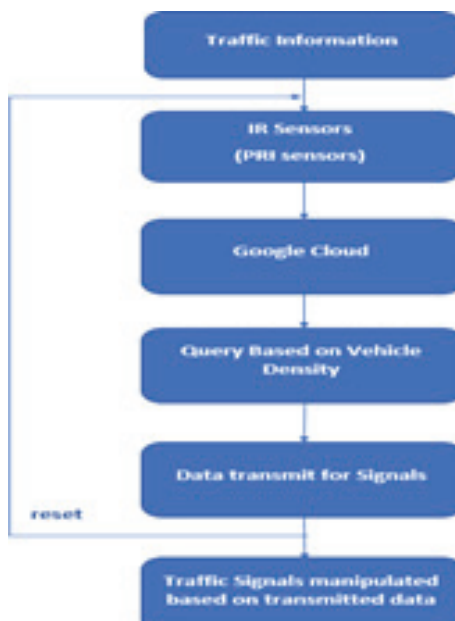
Fig 1: Flow chart of advanced traffic management system

Based upon these three conditions we go query in the Google cloud itself. Then signals manipulate based on the information or signals transmitted by the Google cloud. Finally, at the last stage, the cycle will repeat then control will be transmitted to the top of the flowchart as shown in Fig-1.

IV. IMPLEMENTATION

Traffic management automation systems in the market aim to computerized the traffic lights operates on the periodic to control the light (red/green) uses various technologies like GSM, NFC focuses on the basic operation of an electrical switch. Our project plan to provide an automated IR-sense based solution that makes traffic signals to shift the lights (red/green) dynamically. We plan on implementing the project for one junction "proof-of-concept" for this paper, which includes traffic lights, IR-sensors, Wi-Fi transmitters. The sensed data gathered from the IR sensor is transmitted by the Wi-Fi transmitter. Based on this compilation it dynamically shifts the time of the red signal and the user gets an intimation of the status of the signal on his way. The central console gathers all the data from sensors and stores it in the cloud which intimates traffic status to a mobile device.

A. Module Description

The module thus implements Density based traffic controlling system using IR technology. PIC is a very efficient architecture used for low-end security systems and IR technology is widely adapted technology for communication. Current work focuses on the effective usage of IR and PIC controller for digital security systems. The proposed system provides the count of the vehicles at either side of the junction while those vehicles are near the particular junction. Once the circuit is connected and coded, the circuit is sensed through the IR sensor for testing. This IR sensor is mainly used to describe the optoelectronic means for sensing the things, commonly known for photodetection. While testing keeps the transmitter & receiver aligned in a straight position facing each other. It deals with the proposed

work and its Hardware & software requirements of the Traffic control system. And what would be the output for the given input? It also explains the process of managing the traffic in a city by making a connection to the cloud server.

B. Vehicle Sensing

Vehicles can be identified using suitable sensors for the real-world scenario, but for demonstration purposes, we have used IR sensors for the identification of vehicles. There are two types of infrared (IR) detectors, active and passive. Active infrared sensors operate by transmitting energy from either a light-emitting diode (LED) or a laser diode. An LED is used for a non-imaging active IR detector, and a laser diode is used for an imaging active IR detector. If you are talking about a general IR sensor used in college projects then its range is maxing 4–5 meters.

C. Signal Updating

Our project mainly works in the round robin in which control flow through signals s in Circle format. At initial stage the control is passed to signal one based upon density signal is manipulated after execution the control flow through the next signal, the value updated to the firebase based on density in which number of vehicles detected in an interval of time then based upon the count.
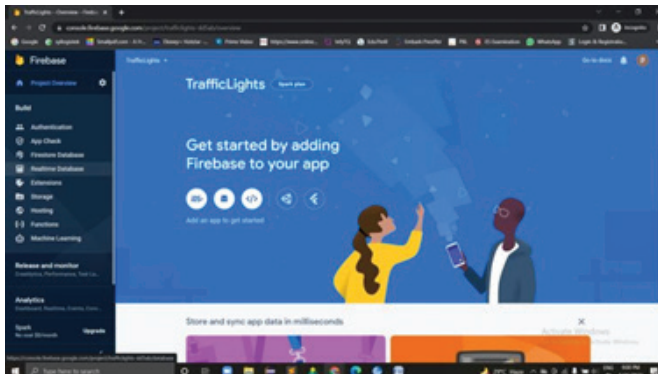
D. Snapshots

Fig. 2: Firebase Project i.e. TrafficLights

The density value updated to firebase node the value stored in the format of JSON (java script object notation) in key value pairs. The applications are shown in Fig. 2, 3, & 4.
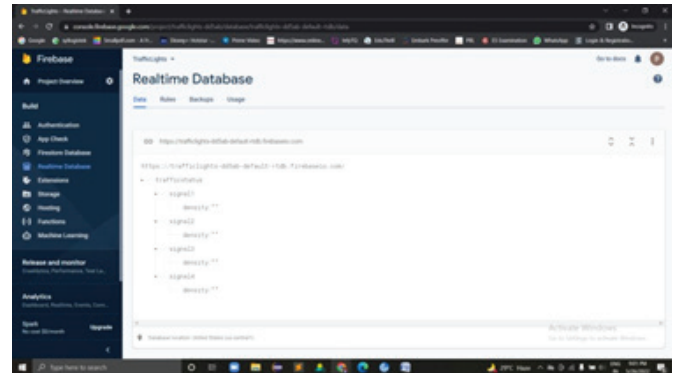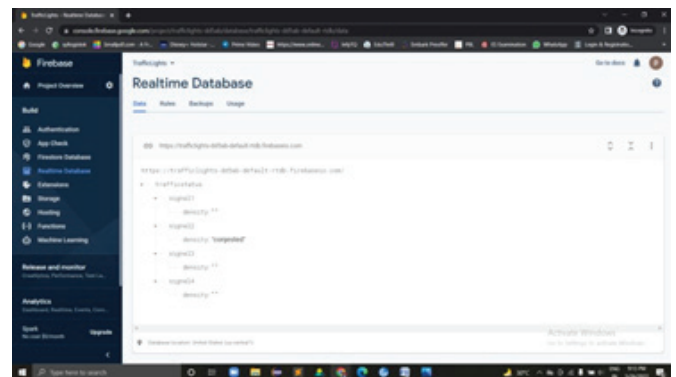

Fig. 3. Signals with Traffic Density

Fig. 4. with Traffic density Congested at Signal2.

V. CONCLUSIONS

This system reduces huge traffic queues caused by the conventionally implemented system used in many places. This Cloud-based Smart Traffic Management System has been developed by using multiple features of hardware components in IoT. Traffic optimization is achieved using IoT platform for efficient utilizing allocating varying time to all traffic signal according to available vehicles count in road

path. Smart Traffic Management System is implemented to deal efficiently with problem of congestion and perform re- routing at intersections on a road. This research presents an effective solution for rapid growth of traffic flow particularly in big cities which is increasing day by day and traditional systems have some limitations as they fail to manage current traffic effectively. Keeping in view the state of the art approach for traffic management systems, a smart traffic management system is proposed

to control road traffic situations more efficiently and effectively. It changes the signal timing intelligently according to traffic density on the particular roadside and regulates traffic flow by communicating with local server more effectively than ever before. The decentralized approach makes it optimized and effective as the system works even if a local server or centralized server has crashed. The system also provides useful information to higher authorities that can be used in road planning which helps in optimal usage of resources. It also enables traffic lights to work continuously with less chances of malfunctioning. The system in simple words provides a simple yet effective solution to improper traffic management systems.

ACKNOWLEDGMENT

REFERENCES

[1]   Rajasheswari sunder, Santhoshs Hebber, and Varaprasad Golla, "Implementing intelligence Traffic control system for congestion control, Ambulance Clearness, and Stolen Vehicle Detection "IEEE Sensors Journal, Vol. 15, No.2 February 2015.

[2]   M.Vidhyia, K.Paramasivam, S.Elayaraja, S.Bharathiraja Reordering of Test vectors using weighting factor based on Average power for test power Minimization, Vol.4, No.2, 2015, pp.10-15.

[3]   K.Vidhya, A.Bazila Banu, "Density Based Traffic signal System", Volume 3, Special Issue 3, March 2014.

[4]   Priyanka Khanke, prof. P.S.Kulkarni, "A Technique on Road Traffic Analysis using Image Processing", Vol. 3 Issue 2, February 2014.

[5]   Ms. Pallavi Choudekar, Ms. Sayanti Banerjee Prof. M.K. Muju, Real-Time Traffic Light Control Using Image processing " Vol.2, No. March 2014.

[6]   R. Nithin Goutham1, J. Sharon Roza2, M. Santhosh3, Intelligent signal control system, Vol.3, Special Issue 4, May 2014.

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World's first giant swing
(Source: Globaltechoutlook)

A start up called "ManaliSwing" incubated at IIT, Mandi has created a large swing that is backed by artificial intelligence which would provide impeccable security to jumpers. Here, one freefall is followed by a gigantic swing on dual dynamic rope with over 100 different jump types, enabling one to feel the exhilaration of a 70m free fall. The AI will track participant and jump master performance across millions of data points and deliver optimized approvals for jumping. A very smart AI will provide a Jump Master and his crew an advantage in ensuring that no injury, incident, or causality occurs on the site. For example, if the jump protocol or international standards is not followed, AI will not approve the jump.

### First public global fossil fuels database
(Souce: eastcoastdaily)

For the first time, a database was created to monitor the production, reserves, and emissions of fossil fuels worldwide. The Global Registry of Fossil Fuels contains information from more than 50,000 oil, gas, and coal resources spread over 89 countries. According to sources, this is the first collection of this size made accessible to the general public, and it includes 75% of global reserves, production, and emissions. Such information can support environmental and climate groups' efforts to pressure their governments to cut carbon emissions.

Plastic Upcycling(Source: The Indian Express)

Researchers have developed a breakthrough upcycling process that can help transform the most frequently used plastic in the world, polyethylene (PE) into polypropylene. In the reactor, polyethylene molecules are repeatedly chopped into tiny pieces of propylene molecules. At starts of the process, a catalyst removes hydrogen from the PE chain to create a space where a reaction may take place. Following this, a second catalyst divides the chain in two, and then a third catalyst advances the reaction up the PE chain so that the first catalyst may carry out the same process again. When the process is complete, 95 per cent of the finished product is propylene. The remaining 5% is made up of butene, a substance with several applications in the manufacture of rubber, gasoline, and plastics. The research faces a few obstacles that is the catalyst stability. So an extremely robust catalyst remain unaffected by PE waste impurities is required.

Disposable electronic components could be printed on paper (Source: E&T News)
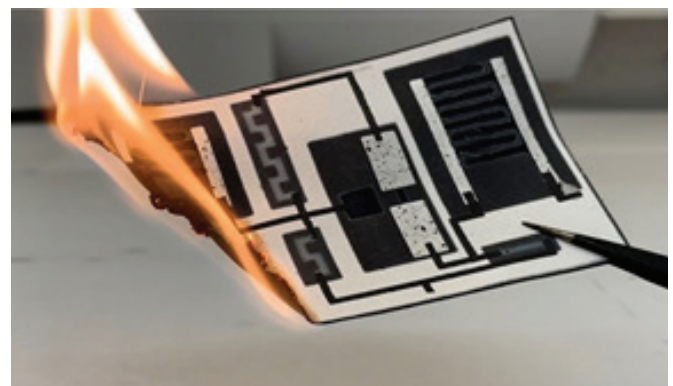
Researchers in the US have developed a paper-based prototype circuit board with fully integrated electrical components that can be burnt or allowed to deteriorate without producing any e-waste. It is intended to be simple to carry and recycle an amplifier circuit built on paper that includes transistor, capacitor, and resistor. A basic design of channels was printed with wax onto a piece of paper. The researchers printed semiconductive and conductive inks, which soaked into the parts not blocked by wax, after melting the wax so that it soaked into the

paper. Later, they screen-printed more conductive metal parts and cast an electrolyte made of gel onto the sheet. Even with the addition of the components, the finished circuit remained extremely flexible and thin, similar to paper. The team showed that the complete device swiftly burnt to ash after being placed on fire to illustrate the circuit's degradability. This is a step toward creating entirely disposable electrical gadgets.

Hydrogen-diesel dual-fuel direct-injection (H2DDI) (Source: E&T News)
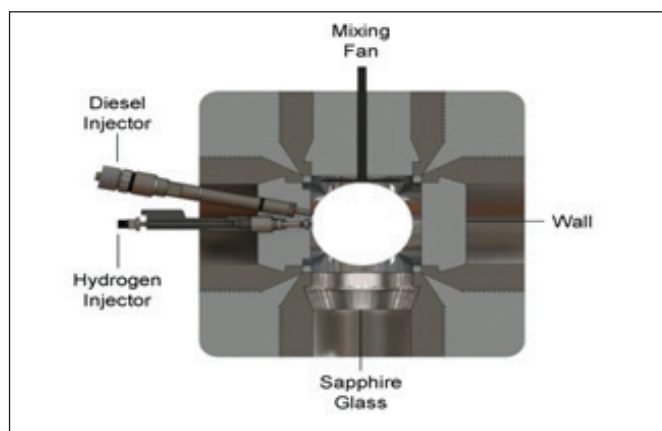
Researchers from the University of New South Wales (UNSW) in Australia have created a hydrogen-diesel direct injection dual-fuel system that considerably reduces carbon emissions. This study discovered that precisely timed hydrogen direct injection regulates the mixture condition inside the engine's cylinder, reducing the harmful nitrogen oxide emissions that have been a major impediment to the commercialization of hydrogen engines. The diesel-hydrogen hybrid has also shown to have an efficiency increase of more than 26% when compared to traditional diesel engines. The figure shows a schematic of the CVCC (constant-volume combustion chamber) setup.

Click Chemistry, method for cancer treatments (Source: E&T News)

The esteemed Nobel Prize has been awarded to Professors Carolyn R. Bertozzi of Stanford University, Professor Morten Meldal of the University of Copenhagen, and Professor K. Barry Sharpless of Scripps Research "for the discovery of click Chemistry and bioorthogonal chemistry."

Click Chemistry is a process by which molecules are simply, quickly, reliably and repeatedly joined together, similar to a Lego set. According to the study, water should be utilised for click reactions rather than the hazardous solvents that synthetic chemists often employ to dissolve their reactants. Bertozzi's groundbreaking discovery made click Chemistry work in living cells, meaning scientists could do "chemistry inside the human body, to make sure drugs go to the right place and stay away from the wrong place", one of the researcher said. This method has been beneficial to target radiotherapies directly to cancer cells, reducing the harm to nearby healthy cells.

Smartphone cameras and flashes could be used to measure blood oxygen levels (Source: The Indian Express)

Researchers have discovered that the camera and flash module of a smartphone may be used to measure blood oxygen saturation levels as low as 70%. Participants in the research put their fingers above a Google Nexus 6P smartphone's camera and flash module to test their blood oxygen levels. The portion of the finger illuminated by the flash receives fresh blood with each heartbeat. This data were used to train a deep-learning algorithm to accurately predict blood oxygen levels from the values.

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# Development of Vaccines and Testing for COVID-19

As we all know, coronavirus was once connected to milder infections like the common cold, but three variants—Severe Acute Respiratory Syndrome Coronavirus (SARS-CoV), Middle East Respiratory Syndrome Coronavirus (MERS-CoV), and SARS-CoV-2—are now connected to serious illness and mortality in infected people, causing the havoc or global pandemics around the world. Making fresh, long-term plans is essential to halting the virus's global spread. As a result, a large number of researchers and scientists have been able to create trustworthy vaccinations using the aid of biotechnology.

A new strategy to boost the production yields of protein-based vaccines has been discovered by many synthetic biologists, potentially expanding access to life-saving medications. Dr. Katalin Karikó recently made a significant contribution to the creation of COVID-19 vaccines, and she was also awarded the "2022 Vilcek Prize for Excellence in Biotechnology." Karikó demonstrated that messenger RNA (mRNA), which is made up of nucleosides, may be modified to make it safe for use in pathogen-specific vaccinations. Her research on the stabilising effects of changing the nucleotides in mRNA allowed scientists to create mRNA vaccines for COVID-19, most notably those created by Pfizer and Moderna. In clinical trials, the vaccines had a 94 percent success rate in preventing symptoms of illness; as a result, they are now being administered throughout the United States to help halt the pandemic.

The World Health Organization classified COVID-19 as a global pandemic in March 2020 due to its high level of contagiousness and quick transmission among people. A method that can track the development of the viral genome, the appearance of virus variations, and identify potential transmission chains is extremely desirable since vigilant testing and tracing are vital for managing the SARS-CoV-2 virus. (2,3) A quick, affordable, and precise instrument that can identify genetic variations in the SARS-CoV-2 genome with single base precision is necessary for this method.
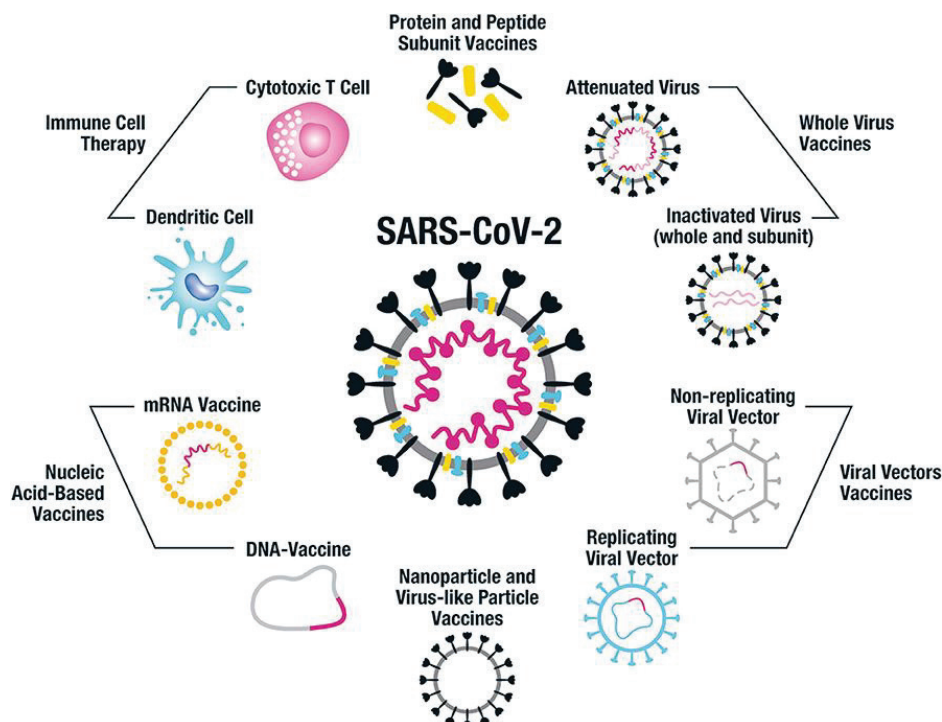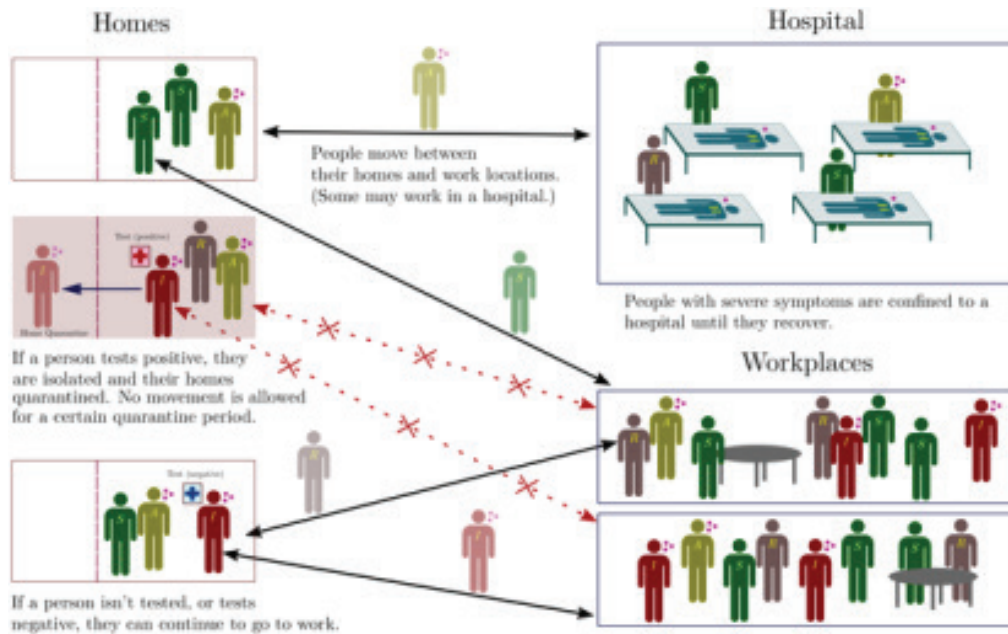
The disease-causing virus, SARS-CoV-2, is anticipated to stay with us for at least a few months despite recent revelations of encouraging phase III findings on Covid-19 vaccinations. The only way to provide quality healthcare and halt the disease's spread is to locate those who are affected. Traditional sequencing techniques are time- and money-consuming, and conventional clinical testing procedures can yield misleading results. Recently, Jeremy Edwards and his colleagues at The University of New Mexico's Computational Genomics and Technology (CGaT) Laboratory created a chip that enables genome sequencing for viruses like COVID-19 considerably simpler and quicker. Eight clinical samples from patients in Wyoming who tested positive for SARS-CoV-2 as part of the study were quickly and accurately resequenced for the viral genome using a tiled genome panel that the researchers had developed for efficient and affordable entire viral genome resequencing Finally, with an efficiency of above 99.9%, they were able to identify 95% of the genomes of each sample. Professor Edwards of the University of New Mexico Department of Chemistry and Chemical Biology even said that this
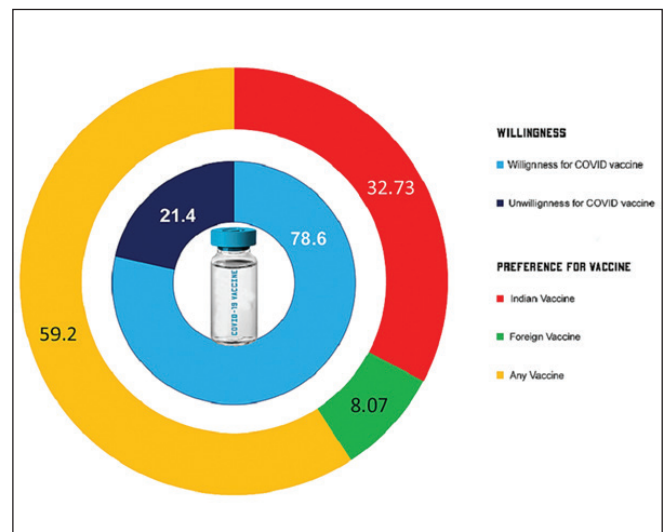
new chip might make it possible to trace COVID and other viruses, including novel varieties, more quickly and accurately.

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Machine learning for functional characterization of proteins

Systems biology is a system-level understanding of complex biological systems. It is an integration between computational/mathematical models and experimental biology. It aims to predict and characterize the dynamic properties of biological systems. Prediction of protein function is one of the important aspects of systems biology. Proteins are important macromolecules responsible for almost all biological functions in a cell including growth, repair, and maintenance. Prediction of protein function helps to understand the molecular mechanism in biological systems, which in turn is used in the drug designing process. Another important application of function prediction is the production of biofuels. Hence many approaches have been developed for the functional characterization of proteins. The wet lab methods for functional characterization of proteins are expensive and time-consuming whereas computational methods are fast and cost-effective with predictive accuracy comparable to wet lab methods. There are many computational methods available for identifying the function of a newly sequenced protein. The classical methods for predicting protein function relies on identifying the similarity of the given protein P to a protein P' of known function, by using sequence alignment. Using the sequences similarity approach, the accuracy of prediction is significant if the sequences and structures exhibit high similarity. However, there are biological sequences that have similar structures and functions but they exhibit very little similarity when their sequences are compared. Therefore, the use of the sequence similarity method results in the accuracy being significantly lower along with a greater degree of deviation from the accurate outcomes in the event of the sequences exhibiting less similarity. Hence, to tide over this limitation, many computational methods based on nonalignment methods were developed.

This thesis aims to develop machine learning-based models to predict the functions of proteins, especially the enzyme proteins efficiently. The first contribution of the research is designing a multiclass Support Vector Machine (SVM) with a feature selection model to efficiently classify the enzyme classes of an enzyme protein. In this work, first, a protein is classified as enzyme or non-enzyme using a binary SVM. This gives an accuracy of 98.37%. If the protein is an enzyme then it is grouped into 6 functional classes using One Vs One multiclass SVM. Initially, 32 features are used to represent the proteins. For selecting the relevant features which contribute more for classification Orthogonal Feature Selection (OFS), Sequential Floating Forward Selection (SFFS), and SVM based Recursive Feature Elimination (SVM-RFE) are implemented. It is observed that multiclass SVM along with the OFS feature subset selection model performs better than other implemented methods. The accuracy obtained by this model is 89.6321% to 94.3144% for class level prediction.

The next objective of the work is to classify the enzymes at the subclass level. As we go down the hierarchy of enzyme classes and subclasses, the number of subclasses becomes large. Since the features of the protein are highly co-related, to identify the relevant features for classifying a large number of classes along with optimizing the parameters of the classifier, becomes a complex task. Hence, to optimize the parameters of SVM and to select the significant features a Modified Teaching Learning Based Optimization (MTLBO), algorithm is developed. Its performances are compared with GA, PSO, and DEfor optimizing the Ackley's Function, the Griewank's Function, the Rastrigin's Function, and the Rosenbrock's Function. It is found that MTLBO performs better than the above algorithms for optimizing the aforesaid benchmark functions.

Furthermore, for classifying a large number of classes, the existing multi-class classification algorithms need O(n) a O(n^2) number of classifiers depending on the multiclass SVM classification method used.So to handle the classification of a large number of classes a binary encoded multiclass SVM (MSVM) classifier is generalized, which can handle an n class classification problem with O($\lceil \log_2(n) \rceil$) number of classifiers. Then a hybrid model using binary-encoded SVM along with the MTLBO (MSVM-MTLBO) is designed to classify the class and subclasses of the enzyme proteins in one step. It requires

only **6** classifiers to predict 63 the subclasses as against 63 or 1953 classifiers. The recall of MSVM-MTLBO using only 25 features ranges from 60% to 98.25% considering 63 subclasses starting from EC1.1 to EC7.6. Though the minimum prediction recall is 60 %, only for EC1.12, EC1.18, EC1.21, EC2.10, and EC3.7 the recall is below 70 % which maybe because there is no sharp difference between the subclasses. For 76% of the subclasses, the recall is above 80%. Since the model uses only $O(\lceil log_2(n)\rceil)$ classifiers to handle n class, it reduces the prediction time and helpful when the number of classes is large. The model predicts the function of a new protein in 0.0113 seconds on an average. The proposed model predicts the class and subclass labels in one step, so the error occurred in one class label prediction does not flow to the subclass label hence improves the classification accuracy. The proposed model selects the relevant features for classification, uses less number of classifiers, hence reduces prediction time, and performs better than the existing methods for subclass classifications. The results of all the feature selection algorithms implemented show that the Physicochemical properties Gln(Q), Leu(L), Lys(K), Phe(F), Pro(P), Thr(T), Trp(W), Tyr(Y) and Oxygen(O) play a major role for protein function prediction.

Dr. Debasmita Pradhan

How drones could be the future of Indian farming

India's agricultural sector has usually not kept pace with new technology, relying largely on traditional methods.

But start-ups specialising in drone technology are trying to change that - one farm at a time.

These companies are encouraging farmers to use drones to monitor the health of crops and spray them with fertiliser and pesticides. The trend comes amid the federal government's ambitious plan to make India a hub for drones by 2030.

The BBC's Arunoday Mukharji travelled to Kancheepuram district in the southern state of Tamil Nadu to understand how farmers are adapting to working with the device on their fields.

5G technology Launched in India

5G technology was recently introduced in India. Major Indian telecommunication companies such as Jio, Airtel, and Vodafone are in the process of rolling out 5G services in select cities across India. The government has also allocated spectrum for 5G trials and plans to auction 5G airwaves in the near future. 5G is expected to bring advancements in areas such as virtual reality, internet of things (IoT), and autonomous vehicles.

" Excerpted from : Technology - BBC News"

UN Convention on Biological Diversity (CBD), Dec 2022

The opening session of the 15th Conference of Parties to the United Nations Convention on Biological Diversity (CBD) began with a severe and stark reminder to end the war on nature, by the UN Secretary-General Antonio Guterres.

He stated that "Humankind is treating nature like a toilet" by poisoning the land, water and air with chemicals, pesticides and plastics, and urged immediate and urgent action to tackle a biodiversity apocalypse.

This summit is an international meeting bringing together governments from around the world. Participants will set out new goals to guide global action to preserve biodiversity through 2030 to halt and reverse nature loss. Land- and sea-use change, overexploitation of species, climate change and pollution and invasive non-native species need to be tackled urgently.

The framework must address the root causes of destruction, like harmful subsidies, misdirected investment, unsustainable food systems and wider consumption and production patterns.
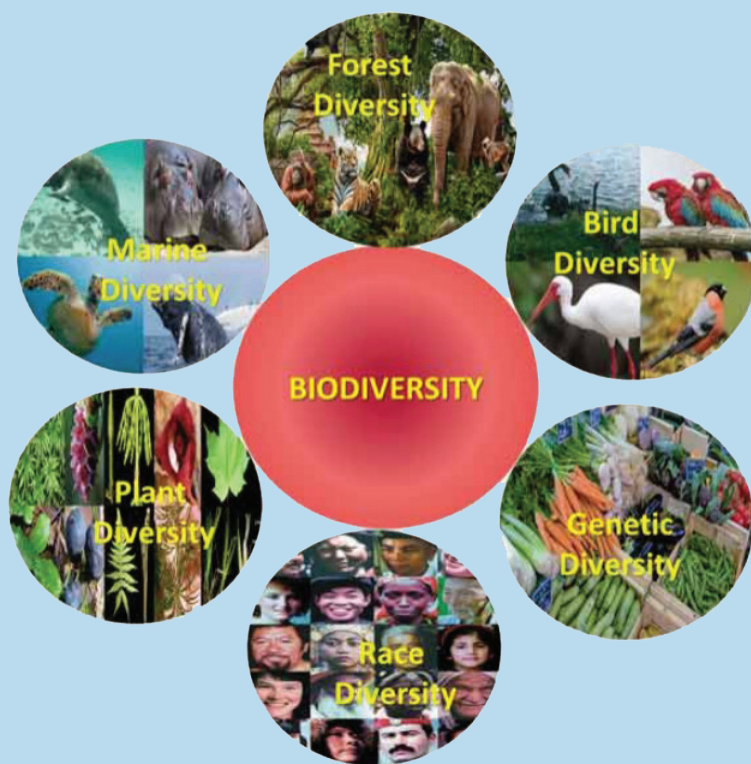
The rights of Indigenous Peoples and local communities, who have always been the most effective guardians of biodiversity, also need to be recognized and protected.

The food and agricultural industry also needs to move towards sustainable production and natural means of pollination, pest control and fertilization.

The timber, chemicals, building and construction industries have to take their impacts on nature into account and industries like biotech and pharmaceutical must share the benefits of biodiversity fairly and equitably.

The new framework must support the global agreements aiming at protecting our planet that can bring us closer to achieving the UN-mandated Sustainable Development Goals.

(Suggested Inclusion of the: https://www.downtoearth.org.in/news/environment/humans-treating-nature-like-a-toilet-un-chief-says-in-montreal-86424)
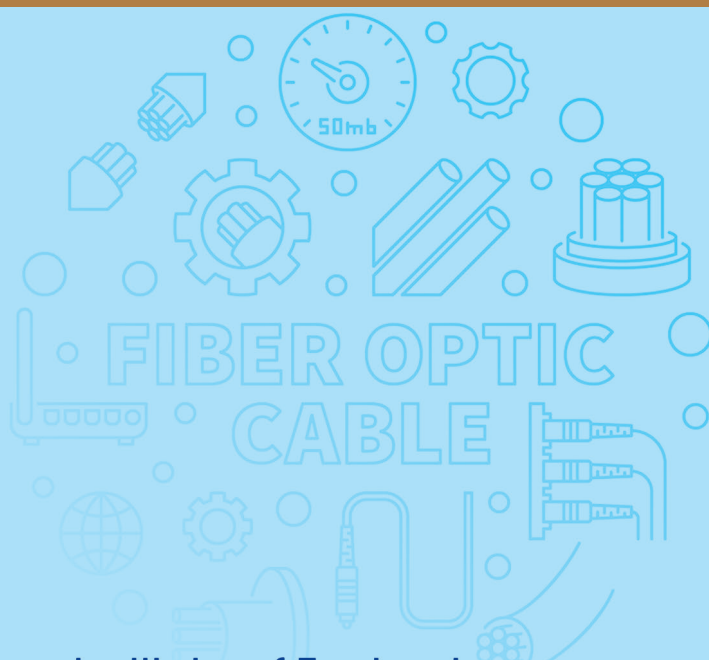
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