SPECIAL FEATURE

IoT Based Solar Monitoring System

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Self-driving cars

Autopilot self-driving cars are able to drive with minimum human involvement. These cars are making driving safer and easier for people. Tesla is one of the most famous companies making these self-driving cars.

The auto-pilot mechanism consists of features like forward-facing radar, cameras all around the car,several long-range ultrasonic sensors, digitally controlled electrical braking system, rear view camera of maximum 50m distance and on-boardcomputer processors that are used to store the sensor data.Autopilot appears to be the future of driving.

The Tesla Model S uses a forward-facing radar that senses around 250m forward obstacles. A Tesla's self-driving system starts working when the car reaches a minimum speed of 32 km/h. The autopilot system steers the car in the middle lane of the road. The braking system is also digitally managed. Autopilot will not work if the road markings are not clear. This system warns drivers to take controlof driving. If the driver does not take control, the car will slowly brake and cometo a stop. The autopilot is primarily used forhighway driving and parking.

AI (Artificial Intelligence) technology powers self-driving car systems. Self-driving car developers use machine learning and neural networks, as well as vast amounts of data from image recognition systems, to build systems that can drive autonomously. Neural networks identify patterns in data that are used by machine learning algorithms. This data includes images from the self-driving car's camera, from which the neural network can identify traffic lights, trees, pedestrians, road signs, and other parts of a particular driving environment.

Google's self-driving car project called Waymo uses a combination of sensors, lidar (light detection and ranging - a technology similar to radar), and cameras to capture all the data these systems generate. The objective is to identify everything around the vehicle and predict what might be the outcome. This data processing and prediction happens in a fraction of a second. The more the system drives, the more data it can integrate with its deep learning algorithms and make better driving decisions.

Autonomous driving features available in many production vehicles from 2019 include hands-free steering, which keeps the car centered without the driver holding the steering wheel; however, drivers should continue to pay attention. Adaptive Cruise Control (ACC) automatically maintains a selectable distance between the driver and the vehicle ahead until the vehicle comes to a stop. Lane centering steering intervenes when the driver crosses a lane marking by automatically pushing the vehicle towards the opposite lane marking.

Every year millions of people die due to road accidents. As per estimates most of the serious accidents are the result of human error, poor judgment, drunk driving or distracted driving. Self-driving cars remove these risk factors, but they remain susceptible to other factors, such as mechanical problems that cause accidents. If self-driving cars can significantly reduce the number of accidents, the economic benefits could be immense. Injuries caused by accidents impact economic activity to a great extent and reduce life quality. When this technology will be available to the masses around the world remains to be seen – hopefully in the near future.

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IoT Based Solar Monitoring System

Abstract : *Renewable energy sources are proven to be reliable and accepted as the best alternative for fulfilling our increasing energy needs. Solar photovoltaic energy is the emerging and enticing clean technologies with zero carbon emission in today's world. To harness the solar power generation, it is indeed necessary to pay serious attention to its maintenance as well as application. The IoT based solar energy monitoring system is proposed to collect and analyze the solar energy parameters to predict the performance for ensuring stable power generation. The main advantage of the system is to determine optimal performance for better maintenance. This paper presents a remote monitoring system, supplemented with data analytics capability that affords real time performance monitoring of the renewable energy system and also helps in the maintenance schedule.*

Keywords: Photovoltaic (PV), Smart Energy Management (SEM), Internet of things (IOT), Real-time monitoring and controlling unit (RMCU), Solar Tracking System, (STS), Wireless Sensor Network (WSN).

I. INTRODUCTION

Solar energy has become one of major clean energy sources around the world in the recent years. Especially in Indonesia, solar energy has a potential of 4.8 kWh/m2 or equals to 112,000 GW. Unfortunately, only 10 MW was already utilized up until now. Based on the roadmap arranged by the Ministry of Energy and Mineral Resources of the Republic of Indonesia in 2017, solar energy is expected to be utilized until 6,5 GW in 2025 . The main application of solar energy is electrical generation through a photovoltaic (PV) system. This system consists of solar panels that can directly convert sunlight or solar energy into electricity. PV is one of the renewable energy sources with the greatest future projection due to its unique features such as simple installation, high reliability, low maintenance cost and zero fuel cost. However, the amount of energy produced from this system is sometimes unpredictable due to the unpredictable nature of the solar energy. Several factors can contribute to the total energy produced by PV, namely the intensity, angle and duration of the sunlight, the temperature of the panel and also some environmental conditions such as weather, wind and dust. To increase the total energy produced by a PV system, sufficient measures need to be taken on its installation. However, since a PV system is usually located in a remote or high location, there still be chances of failures or maintenance problem during its operation. These methods have some disadvantages such as time-consuming and wiring complexity [1]. The emerging technique of communication technology called Internet of Things (IoT) offers a new solution to overcome these problems. The IoT is the network of physical objects embedded with electronics, software, sensors, and network connectivity. It allows objects to be sensed and controlled remotely across the existing network infrastructure resulting in improved efficiency, accuracy and economic welfare. Hence, the communication network with IoT can provide a better monitoring and controlling of a PV system in a remote and large field compared to human inspection.

II. OVERALL SYSTEM DESIGN

The system described in this paper is capable of measuring the values of Solar PV voltage and current and temperature. Sensors is connected both side of solar panel, voltage sensor detects the voltage drop according to that motor rotates to get maximum power by tracking the movement of sun. In our proposed system we have used an ESP8266 Microcontroller to control the Movement of Solar Panel to get the Maximum Power out of the cells, which is driven by a motor driver [2]. And we have used Motor Controller driver IC's, these IC's are widely used in electronic circuits to control the motor with ease and to drive it efficiently. L293D is a similar motor driver mostly employed along with the Microcontrollers to perform the motor action. The circuit diagram is shown in Fig.1.

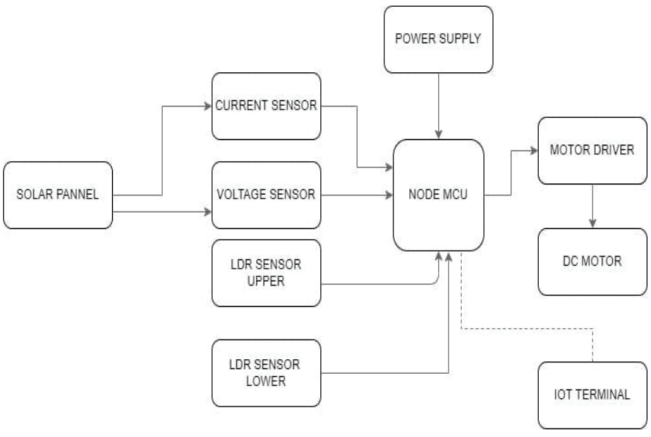

Fig 1. Circuit diagram

III. COMPONENTS REQUIRED

(i) ESP8266

ESP8266 is a 3V Wi-Fi module very popular for its Internet of Things applications as shown in Fig. 2. Maximum working Voltage is 3.6V. Software like Circuito.io, Tinker cad, Fritzing to are used to simulate and work with the board safely. We can use Logic Level Controller with ESP8266 module.

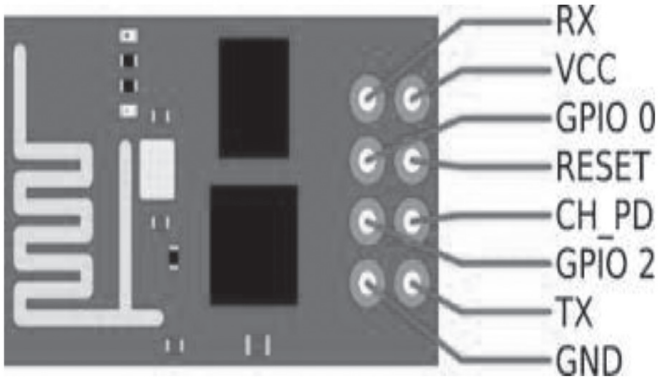

Fig. 2 ESP8266 Module

(ii) Motor Driver

Fig. 3 shows a Motor Controller driver IC widely used in electronic circuits to control the motor with ease and to drive it efficiently. L293D is a similar motor driver mostly employed along with the Microcontrollers to perform the motor action. This IC is capable of driving two motors at a single time in either direction and it can even provide drive currents up to 1A at voltages 4.5V to 36V. The above circuit illustrates the bidirectional motor controller using this simple L293D.

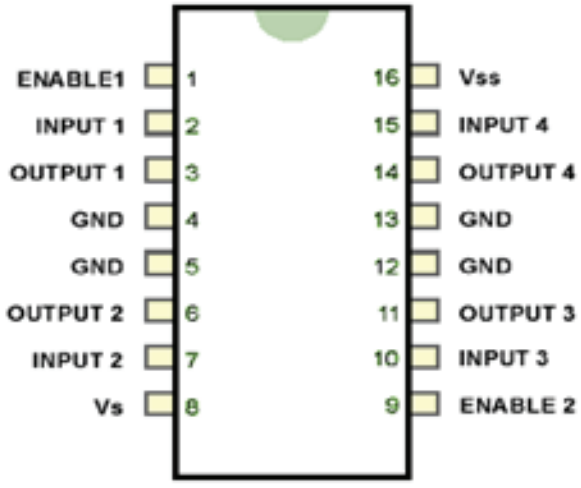

Fig. 3 Motor driver IC L293D

The L293D is a 16 pin IC which is known for their efficiency in controlling DC motors. There are two types of supply voltage for this IC Vs and Vss. Vss is meant for its own internal operation and it will not use this input for driving motors. This Vss input voltage should not exceed 7 V or it will damage the IC. Vss is meant for supplying power to the motor we are about to drive, for example if we are going to drive a 12V motor you should give 12V input to this 8th pin Vs [3].

Enable pins are meant to make the respective motor drivers ready to operate, supplying high signal will activate the corresponding drivers. Enable1 for motor 1 and Enable 2 is for motor 2. Input pins 2, 7, 10, 15 are used to operate the motor in your desired direction. Output pins 3 & 6 should be connected to motor 1, Pins 11 & 14 should be connected to motor 2. Here is a logic table in Table 1 for the inputs of L293D and the motor state corresponding to that input

Table 1. Input Logic Table of L293D

Input1	Input2	Input3	Input4	Motor State
1	0	0	1	Clockwise rotation
0	1	1	0	Anticlockwise Rotation
0	0	0	0	Idle [High Impedence State]
1	1	1	1	Idle

(iii) ACS712 Current Sensor

Fig. 4 shows a current sensor. Current flowing through a conductor causes a voltage drop. The relation between current and voltage is given by Ohm's law. In electronic devices, an increase in the amount of current above its requirement leads to overload and can damage the device [4]. Measurement of current is necessary for the proper working of devices. Measurement of voltage is Passive task and it can be done without affecting the system. Whereas measurement of current is an Intrusive task which cannot be detected directly as voltage.

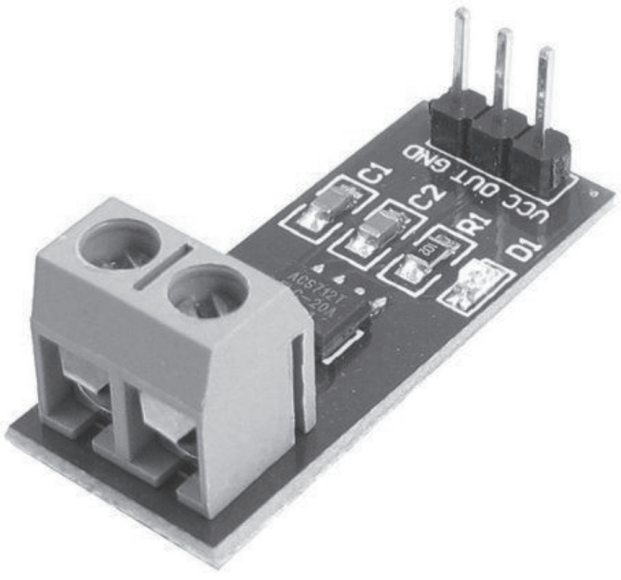

Fig. 4 ACS712 Current Sensor

Current Sensor detects the current in a wire or conductor and generates a signal proportional to the detected current either in the form of analogy voltage or digital output. Current Sensing is done in two ways – Direct sensing and Indirect Sensing. In Direct sensing, to detect current, Ohm's law is used to measure the voltage drop occurred in a wire when current flows through it. A current-carrying conductor also gives rise to a magnetic field in its surrounding. In Indirect Sensing, the current is measured by calculating this magnetic field by applying either Faraday's law or Ampere law. Here either a Transformer or Hall Effect sensor or fibre optic current sensor are used to sense the magnetic field.

(iv) Lead Acid Battery

A lead acid battery is shown in Fig. 5. The lead acid storage battery is formed by dipping lead peroxide plate and sponge lead plate in dilute sulphuric acid. A load is connected externally between these plates. In diluted sulphuric acid the molecules of the acid split into positive hydrogen ions (H+) and negative sulphate ions (SO4 − −). The hydrogen ions when reach at PbO2 plate, they receive electrons from it and become hydrogen atom which again attack PbO2 and form PbO and H2O (water). This PbO reacts with H2 SO4 and forms PbSO4 and H2O (water).

$$PbO_2 + 2H \rightarrow PbO + H_2O$$

$$PbO + H_2SO_4 \rightarrow PbSO_4 + H_2O$$

$$PbO_2 + H_2SO_4 + 2H \rightarrow PbSO_4 + 2H_2O$$

SO4 − − ions are moving freely in the solution so some of them will reach to pure Pb plate where they give their extra electrons and become radical SO4. As the radical SO4 cannot exist alone it will attack Pb and will form PbSO4. As H+ ions take electrons from PbO2 plate and SO4 − − ions give electrons to Pb plate, there would be an inequality of electrons between these two plates. Hence there would be a flow of current through the external load between these plates for balancing this inequality of electrons. This process is called discharging of lead acid battery

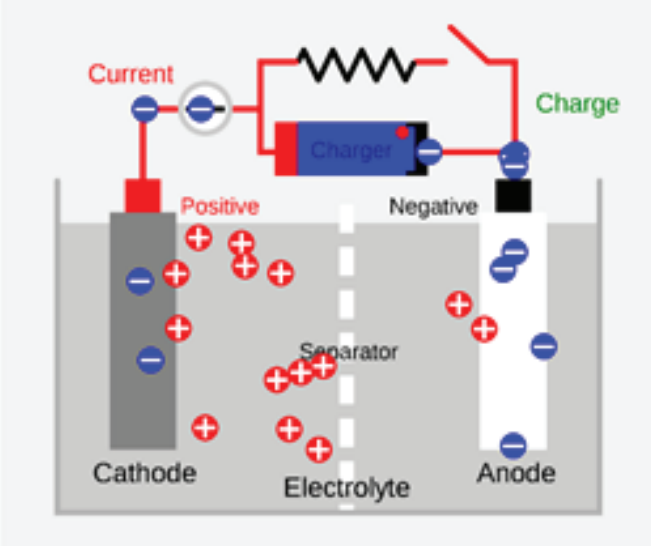

Fig. 5 Lead acid battery

IV. SOFTWARE USED

i) Blynk IOT: -

Blynk is a software company that provides infrastructure for the internet of Things. In 2014 Blynk pioneered the no-code approach to IoT app building and gained global popularity for its mobile app editor. Today businesses of all sizes — from new startups to large enterprises — use our software platform to build and manage connected products. With Blynk, you can create smartphone applications that allow you to easily interact with microcontrollers or even full computers such as the Raspberry Pi. The main focus of the Blynk platform is to make it super-easy to develop the mobile phone application.

With Blynk, we can control an LED or a motor from your mobile phone with literally zero programming. This is actually the first experiment that I will demonstrate in this course. But don't let this simplicity make you think that Blynk is only useful for trivial applications. Blynk is a robust and scalable tool that is used by hobbyists and the industry alike. Blynk is a Platform with an Android app to control Arduino. It's a digital dashboard where by simply dragging and dropping widgets one can build a graphic interface for project. Instead, it's supporting hardware of your choice.

(ii) Arduino IDE

Arduino IDE is an open-source software, designed by Arduino.cc and mainly used for writing, compiling & uploading code to almost all Arduino Modules. It is an official Arduino software, making code compilation too easy that even a common person with no prior technical knowledge can get their feet wet with the learning process. It is available for all operating systems i.e. MAC, Windows, Linux and runs on the Java Platform that comes with inbuilt functions and commands that play a vital role in debugging, editing and compiling the code [5].

V. WORKING

Two sensors are connected to each side of the solar panel and then they are connected to ESP 32. ESP 32 measures the voltage of both the LDR which are connected to each ends of the solar panel. ASP 32 check the voltage drop of LDR and checks the voltage rating and then the motor rotates towards that LDR, whose voltage retting is lower and hands it tracks the movement of the Sun if both the voltage rating are same the motor stays stationary and does not move.

The two wires connected to the solar panel directly connected to the voltage sensor in parallel manner the voltage sensor when received the voltage reading divides the value by 5 and gives the output signal to the ESP 32 module the ESP 32 module is capable of handling the voltage value up to 5 volt if the value increases more than 5 volt the model made damage has the value is divided by 5 and the signal is given to ESP 32 module is connected in the voltage sensor which gives the signal output in the form of voltage drop.

Current sensor the wire connected to the battery is connected to the current sensor in series and the wire at the other and is connected directly to the motor the positive terminal of the solar panel is connected directly to the current sensor and then connected to the voltage sensor the current sensor requires 5 volt input which is supplied to buy the battery and the five voltage taken as the input the current sensor cannot be connected in parallel rather it is connected in series otherwise the current value cannot be changed properly after connecting properly it's census and measures the current flowing into the battery.

ESP32 module has an inbuilt Wi-Fi which has been given a particular SSID and password if a hotspot with the particular exercise and password is enable nearby the chief connects automatically to it and the circuit starts to operate if it connects to that hotspot with the particular SS ID and password the software Blynk IoT displace as online this means at the device is ready to operate the value of the output voltage and the output

current is display in the blink app and it can only display the output value only when the hotspot with the given SSID and password is turned on and the ESP 32 model is connected while coating it in our do you know ID is software the exact SSID and password has to be incorporated for the ASP 32 module so that it can display the correct value of the output voltage and also the output current since we require both 12 volt dc as well as 5 volt dc supply without repeal for the matter of fact we also need some other components as well for example capacitors voltage.

Voltage regulator which we use is used to produce five volt dc output which is used as a signal for the current sensor as well as the voltage sensor the voltage regulator is used to limit the output to 5 volt dc no matter what amount to voltage is applied to the input side the voltage bullet has a certain range up to which input can be applied else it may damage the regulator and which intern the damage the whole circuit.

VI. RESULTS

A photovoltaic module is taken for the experimental implementation and testing the performance with standard ratings of the solar panel as mentioned. The hardware setup is shown. Current sensor which is a sensing device to measure the current in the solar panel. These two parameters highly influence the performance of the solar panel.

Since irradiance is corresponding to current and temperature affects the voltage of the solar module. Hence the power generation of the solar panel relies on temperature and irradiance. The proposed system programming codes are developed in C language via Energeia IDE. This is a non-proprietary integrated development environment designed for Texas Instruments like Microcontroller. The Blynk libraries are included in the programming function to communicate and transfer the sensed values to the Cloud platform. The electrical characteristics are monitored and displayed successfully through a mobile application. The result in Fig.10 shows the real-time Solar PV monitoring system through Blynk.

The inference of output is the increase in temperature reduces the voltage generation in PV and also the rise in irradiance shows a moderate increase in current. Hence these two parameters become the deciding factor for the performance of solar module. The results shown are displayed in the Web server. The previous figure shows the output in serial monitor of PC. The obtained result shown in Table 2 shows results nearer to the Standard ratings of a solar panel.

Table 2. Voltage and Current from model

Voltage	Current
5.28	0.36
5.17	0.36
4.66	0.33
4.5	0.33
3.94	0.27

VII. CONCLUSIONS

The integration of renewable energies into the electricity distribution network has become a necessity and consequently, the search for new and effective solutions for remote monitoring and control is required. In this project, an IOT-based solar panel remote monitoring system has been proposed to collect data on important parameters of solar panels. The continuous record of performance data and failure data enables by IoT, so that it can be used for analytics for predicting and forecasting the future power generation possibilities, income production etc. The frequent maintenance of the photovoltaic systems also gets prevented by it. IoT will play a major role in accessing the control over the photovoltaic system installed at remote locations or far away from the control center.

VIII. FUTURE SCOPE

The controller requires an external supply to work but using the power generated from solar panel itself the controller's input power supply can be met. For very

large solar panel dual axis solar panel tracking can be done. By analyzing the data it is possible to predict the future values of parameters. Artificial intelligence can be implemented using various machine learning algorithms so that the system can become smart enough to take decisions about data and performance.Going forward the solar industry has very clear cost-reduction roadmaps, which should see solar costs halving by 2030. There is already a move in place towards higher-efficiency modules, which can generate 1.5 times more power than existing, similarly sized modules today using a technology called tandem silicon cells. These are going to have a large impact going forward.

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Dr. Salim Ali

One of the pre-eminent ornithologists and naturalists of India, Dr. Salim Moizuddin Abdul Ali better known as Dr. Salim Ali, was born on 12 November 1896. He is addressed as "Birdman of India" at times. A man with such a passion and interest in a different field of science that is not explored enough is highly commendable. He has meticulously observed and documented the birds of the sub-continent for decades henceforth making a tremendous contribution to the field of ornithology.

Ali was a phenomenal key figure behind the Bombay Natural History Society after 1947 and used his clout to amass government support for the modelling of Bharatpur bird sanctuary (Keoladeo National Park) and protecting the now Silent Valley National Park. Ali in collaboration with Sidney Dillon Ripley to indite the Handbook of the Birds of India and Pakistan volume ten. Ali's bloodline belonged to a Suleimani Bohra family in Bombay. From his earlier days, he had a great fascination with books on hunting in India and was an enthusiast in sport-shooting. From frequently dropping out of school due to health issues to his matriculation exam was a tough phase for him. He had a difficult time in his first year of college which made him go to Burma to manage his family business, but due to a lack of interest, he came back to India to continue with his studies. In addition to his chosen course, he also graduated in zoology and worked as a guide in a museum in Bombay Natural History Society. Later he went to Germany for the training purpose. Throughout his research, he was accused of incorrect observation but he proved his point and wrote about his keen interest in the "living bird in its natural environment". He was known for his prudent lifestyle as he saved money at the end of many of his projects. Ali was bestowed with Padma Bhusan-1958 and Padma Vibhusan-1976 and many others and was nominated to the Rajya Sabha in 1985. Ali took his last breath at the age of 90 on 20 June 1987 after a prolonged battle with prostate cancer. India owes him a lot for his sheer contributions in the field of observing birds and surveying them which made his future generations take a keen interest in this field.

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Branch- ECE
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LULC Classification using Machine Learning Models: A Case Study on the Kendrapara District of Odisha, India

Abstract : *Population is increasing day by day and as well as the Land used. So it is important to collect information of land used and covered by human beings. Multispectral satellite images, when used along with terrain analysis output, provide valuable information on structure, soil, land use land cover (LULC), hazards etc. The present work makes an endeavour to classify landforms using a software QGIS, Google earth engine and assess its distribution pattern across different LULC segments and the information about the crops in the Kendrapara District Odisha. Having 2644 km^2 large area the District faces natural calamities every year and known as the flood affected District of Odisha. As the district is mostly depend upon agriculture, detection of LULC and crop classification in this area have become a vital aspect of conventional strategies for environmental monitoring. For the purpose of LULC detection Landsat-8 satellite data of 7th November 2021 is used and four Machine Learning models are used such as Support Vector Machine, Random forest, Maximum Likelihood and Minimum Distance. For Crop classification Sentinel-2 satellite data of 2021 year was taken into consideration. The classified crop land with the classified crop then matched with the ground truth data which we have collected from the localities of Kendrapara district. It will be helpful to know whether a specified crop is yielded on the classified crop land or not on a particular time span. When the government starts any financial plans for the losses of the farmers due to any natural calamities, then it would work as an evidence for the farmlands and it will show whether the crop is yielded in that land or not. For any specific area of the district It will show the history of the crops for a particular timestamp.*

Keywords: Land use and Land Cover, Machine Learning, Remote Sensing.

I. INTRODUCTION

During recent decades the LULC dynamics has been transformed dynamically. This transformation in LULC pattern has been brought by both human as well as natural factors. [1] Therefore, the quantitative assessment of LULC [2] change dynamics [3] is one of the most efficient means to manage and understand the landscape transformation. The land use modifications are dynamic in nature and are caused by multiple factors operating on local, regional and global scales. The rapid and uncontrolled population growth, coupled with industrial development and economic growth, has been continuously transforming the land use pattern. Several potential causes of LULC changes have been identified, such as industrial growth and urban agglomeration, climate change and population growth, urban expansion and policy provisions. As a result, assessment of LULC change is unavoidably necessary for a number of objectives related to human welfare because of the uncontrolled and fast rate of growth of population, industry, and deforestation. [4]..

Numerous strategies for mapping LULC patterns and dynamics from satellite data have been developed, including both classic terrestrial mapping and satellite-based mapping. Terrestrial mapping is popular for field surveying that allows for the production of maps at a variety of sizes and with varying degrees of precision, however it is a manpower-intensive, time-consuming, and expensive method of mapping huge areas. Additionally, mapping is prone to subjectivity. Satellite-based mapping is cost-effective, spatially expansive, multi-temporal, and efficient in terms of time. Historically, satellite data had a lower spatial resolution than maps created by terrestrial surveys. Satellites give data at a variety of spatial and temporal scales due to the evolution of remote sensing (RS) [5]techniques and microwave sensors. Resembles the rapid collecting of information on LULC at a significantly lower cost than other methods such as ground surveys. For LULC mapping, satellite images have the advantages of multi temporal availability and extensive spatial coverage. With the introduction of hyper-spectral [6] satellite sensors, the value of RS in the research sector and for strategic planning has expanded significantly. [7]

Recent interest has been focused on the use of ML techniques to remotely sensed imageries for LULC mapping. The efficacy of LULC classification is dependent on quality of the imagery and spatial-temporal resolution, and ML models.

Numerous investigations have discovered that the LULC classification method, which relies on satellite images, has many spectral, spatial constraints that impair its accuracy. [8] As a result, researchers have started utilizing machine-learning methods to circumvent the constraints outlined previously and create high-precision LULC images. Additionally, not all machine-learning algorithms successfully decrease a high-precision LULC map, as great results are highly dependent on the machine learning algorithm configuration, training set, and input variables. Numerous studies on land use classification [9] using machine learning algorithms have been undertaken so far, but the performance of models has not been thoroughly assessed. We used three machine-learning approaches in this research to determine which method is capable of producing a high precision LULC map based on accuracy statistics.

The contributions of the work are as follows:

- Land use and land cover classification using various machines learning model.
- Generating the feature set from the raster using the shape file of the training and test data.
- Designing different ML models to classify the Kendrapara District.
- Performing accuracy analysis of ML models in view of Confusion matrix.
- Using ML model with high accuracy classify the land used and land covered of Kendrapara District.

II. SURVEY

Numerous studies have been conducted to examine the use of LULC analysis on remotely sensed records. From 1986 to 2001 in Pallisa District, Uganda, Otukeiet al. carried out land cover mapping and land cover assessing using DTs, SVMs and MLCs. They explored the use of knowledge mining to find the required classification bands and thresholds for decision. The analysis assessed the efficiency of the classification models, claiming that land cover elements occur at an unpredictable pace. [10]

KamrulIslam et.al [11] used Landsat TM and Landsat 8 OLI/TIRS images to examine land use changes in Chunati wildlife sanctuary (CWS) from 2005 to 2015. ArcGIS v10.1 and ERDAS Imagine v14 were used to process satellite images and analyze quantitative data for this research area's land use change assessment. To derive supervised land use categorization, the maximum likelihood classification technique was applied. It was discovered that around 256 ha of degraded forest area has increased over a ten-year period (2005–2015), with an annual rate of change of 25.56 percent.

Lloyd L. Coulter et al. conducted land use change in southern Ghana using dense stacks of Landsat 7 ETM+ imagery. They discovered a decline in three types of natural vegetation and agriculture. LULC maps derived between 2000 and 2010 suggest that roughly 26% of the research area saw LULC change over the study period.

Urbanization is a global phenomenon. It is mostly caused by unplanned growth, increased immigration, and a quickly growing population. Land use and land cover change are seen as critical components of contemporary strategies for managing natural resources and monitoring environmental changes in this setting. Ibrahim Rizk Hegazy and Mosbeh Rashed Kaloop used GIS to examine the detection of land use change in Mansoura and Talkha between 1985 and 2010. Change detection study reveals that the built-up area has expanded by more than 30%, from 28 to 255 km2, while agricultural land has decreased by 33%. [12]

Mathias Schaefer and Nguyen Xuan Thinh conducted a detailed analysis of land cover change dynamics in 22 districts of Ho Chi Minh City (HCMC), Vietnam, utilizing moderate and high spatial resolution satellite images (Landsat and SPOT). They discovered that the city has been undergoing significant structural change since the late 1980s market liberalization. Significant difficulties arise as a result of uncontrolled urban sprawl caused by rapid population increase and encroachment on agricultural land. [13]

III. LULC CLASSIFICATION

A.Study Area

Ourstudy area in the Kendrapara district in Odisha is depicted in Figure 1. The District selected is located at 20.50°N 86.42°E. We collected the shape file from ESRI website and presented a extracted map of Kendrapara Dist using QGIS.

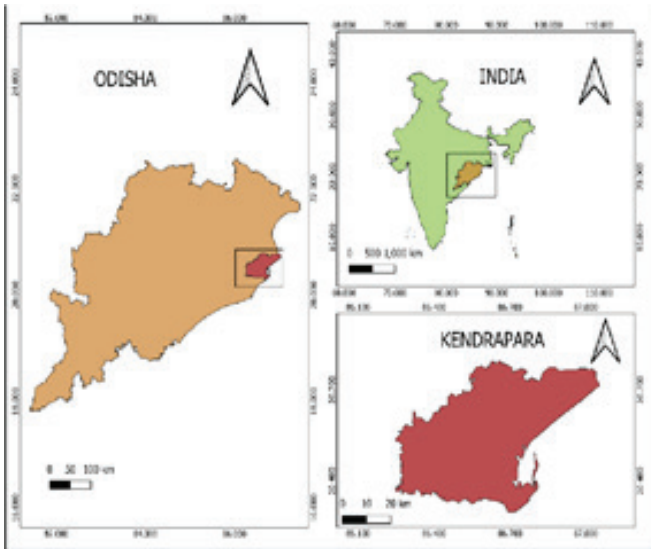

Figure 1. Study Area Map

B. Data Acquisition for LULC classification

In order to establish land usage, land covers (LU/LC) of the study area, Landsat satellite-8 ETM+ data for 2020 have been used. The spectrum consists of six electromagnetic (EM) bands, shortwave Infra-Red1 - SWER 1 and shortwave Infra-Red2 - SWIR 2, including Blue, Green, Red, Near Infra-Red, which is used to classify into five land use classes such as water bodies, agriculture (Area covered by field and Land etc), urbanization forest and bareland. [16]

C. Image Pre-processing

1) Layer Stacking

After data acquisition, this stage is to apply fundamental pre-processing activities framed on the raw Satellite images before its utilization in any further upgrade, understanding, interpretation or analysis. Layer stacking is applied after this for consolidating various images into a single image. The LULC map after layer stacking is portrayed in Figure 2.

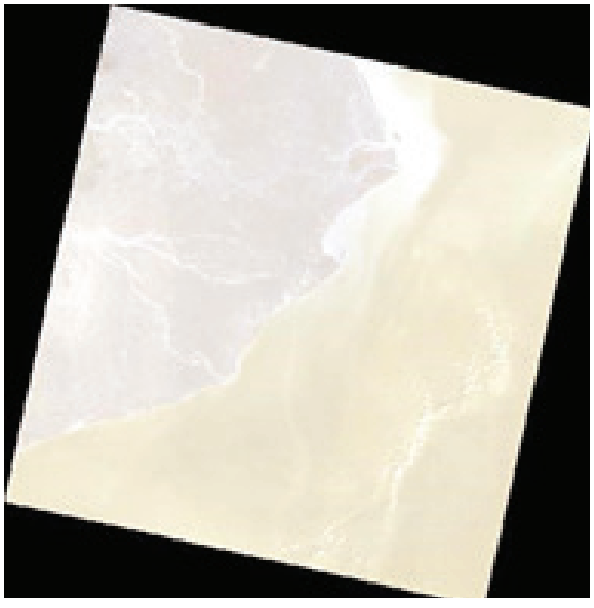

Figure 2. Map After layer Stacking

2) Atmospheric Correction

The atmospheric correction [11] is important when we want to work on images with more than one timestamp. So basically, we implement image classification and want to compare several images between one another. The main aim is the conversion of raster bands of Landsat 8 images from digital numbers to reflectance. Atmospheric correction is applied on the resultant image of layer stacking shown in Figure 2. In our work, the atmospheric correction is implemented using the dark object subtraction method. After implementing atmospheric correction, the generated map is shown in Figure 3.

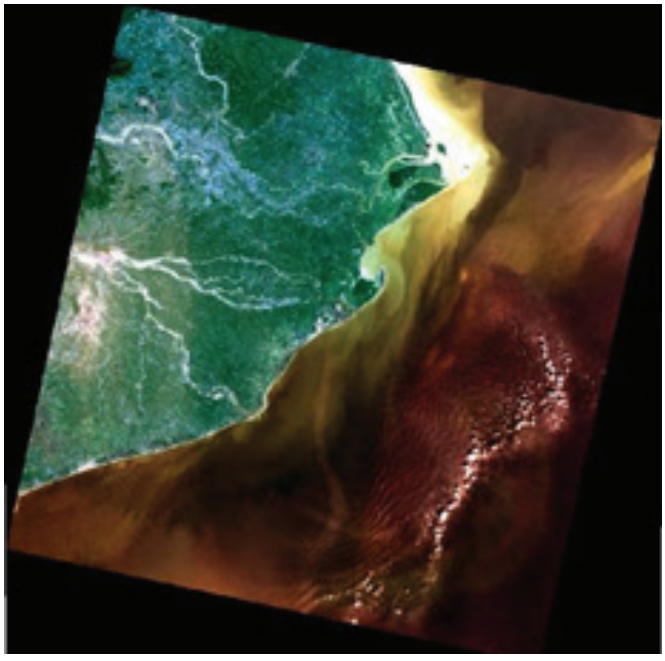

Figure 3. Map After Atmospheric Correction

Table-I Local Data of Crops

A. Data Collected from the localites of Kendrapara District shown in Table-I

Sl No.	Month	Crop
1.	March -May	Jute & Ground Nut
2.	June-July	Coconut
3.	July- August	Brinjal
4.	July- December	Tomato
5.	December	Chillies
6.	June - September	Cabbage / Cauliflower & Ocra
7.	Oct - March	Paddy
8.	April-Sep	Kharif

IV. CROP CLASSIFICATION

In order to proceed for the crop classification it is very essential to do the data acquisition. We proceed to do it using the Sentinel-2 satellite data of each month of the year 2021 by the google earth Engine. Collected shape files of each month are inserted into the Google earth engine [14] to get the desired area. And hence the Kendrapara area is extracted. In order to get the specific view of Kendrapara for crop classification. After layer stacked of each month the map generated is shown in fig 4.

Figure 4. Crop classified map

IV. METHODOLOGY

The proposed LULC classification method consists of three major stages:

- First study area is identified, and data acquisition is performed.
- In the next stage, image pre-processing is carried out with layer stacking and atmospheric correction.
- Then using R we have created a data set of the training shape file.
- Finally, ML model classification is carried out for thematic LULC analysis. It will be our test data after classifying the crops.
- Then the Sentinel-2 satellite data of each month for the year 2021 is collected in google earth engine for the purpose of crop classification and a composite was formed taking each image.
- Basing on the data collected from the localites the crops were classified according to the months.
- Then the LULC data used for the testing to know whether the crop is yielded in the land which is classified as crop land or not.

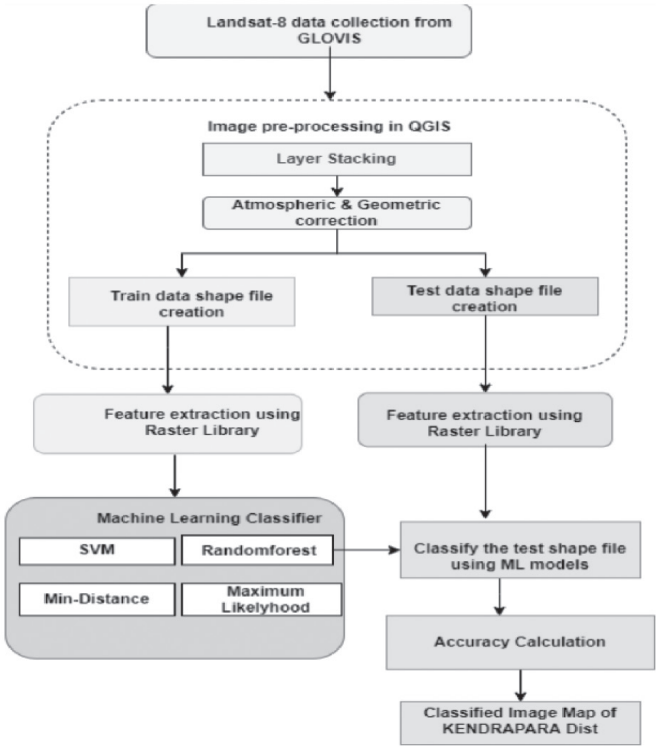

Figure 5. Proposed Model

Image classification is an automated approach for classifying raster data belonging to satellite images, airborne images, drone images etc. This typically includes evaluating several images and applying statistical rules in determining the identity of the land cover for each pixel in an image. In this paper, supervised classification algorithms are applied for land use and land cover classification. All classes of interest are selected to prepare the train and test data set. The proposed model is depicted in Figure 5.

After defining the classes, the next step is the training stage. Machine learning models are data-dependent. Even the most perform ant algorithms can become ineffective without a solid foundation of high-quality training data. Indeed, effective machine learning models can be debilitated if they are initially trained on insufficient, erroneous, or irrelevant data. No component of machine learning is more critical than high-quality training data. The term "training data" refers to the initial data required to form a machine learning model, which the model then uses to create and refine its rules. The quality of this data has a significant impact on the model's ongoing development, establishing a strong precedence for all future applications that utilize the same training data. A sufficient sample size is required to ensure accurate statistical descriptors of our training data. We are classifying the data into four categories using fifteen samples from each depicted in Figure 5. Here representative training areas for the land cover classes are identified for which we intended to map and develop a numerical description or statistics of the spectral attribute. The validation set is used to evaluate a given model. However, it should be evaluated frequently. This information is used to fine-tune the model's hyper parameters. We have taken some small area of Kendrapara District for our training purpose which is shown in Figure 6.

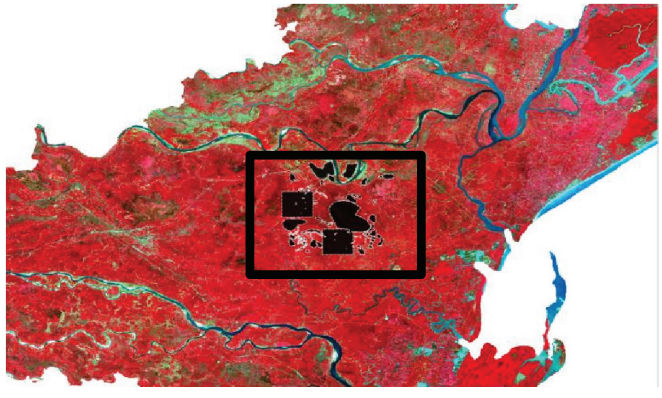

Figure 6. Training Dataset for LULC classification

Then after the lands were classified then we move forward for the crop classification purpose. For recognizing the crops high resolution images were needed so for that we have used the Sentinel-2 satellite data and the data is collected for each month of the year 2021. [15] Then a composite is formed by combining each image. And in order to classify the crops samples of different crops are collected and the training data set is created. Then the machine learning algorithms such as Random-Forest and SVM were applied to the training data set and for the testing purpose the LULC classified data set is used. The image from which the training data is created shown in figure 7.

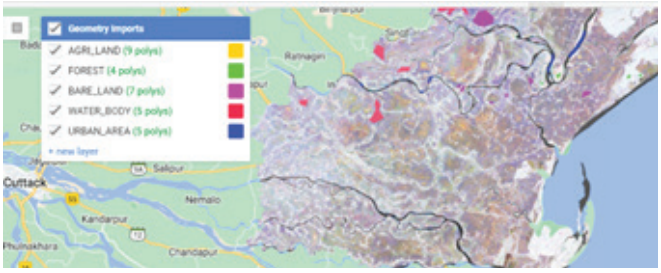

Figure 7. Training data collection for crop classification

V. RESULTS AND DISCUSSION

The purpose of the accuracy evaluation is to determine the quality of the map. If the accuracy assessment shows that the land use land cover map is valid then the resulting map can be utilized in different ways like dramatic maps, all kind of output tables or statistics for the various land cover classes and digital data files amendable to inclusion in GIS. In supervised learning classification, error occurs when a pixel belongs into one class is allotted to another class. Here the question is how to test for it. And basically there are two methods either visual control or quantitative control to test this.

The spectral plot of each class is plotted to know the spectral length of the each sample collected which is shown below in Fig 8 to Fig 12.

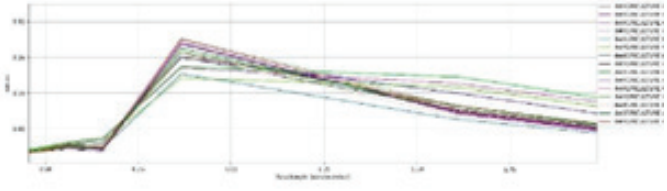

Figure 8. Spectral Plot of Agriculture Class

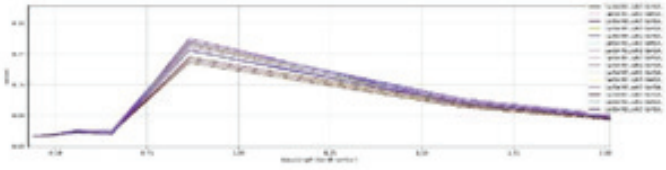

Figure 9. Spectral Plot of BareLand Class

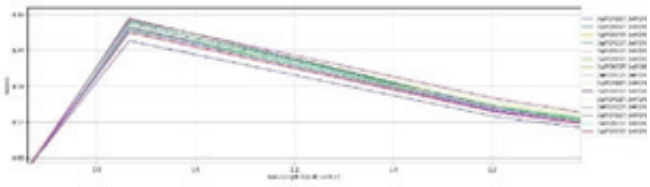

Figure10. Spectral Plot of Forest Class

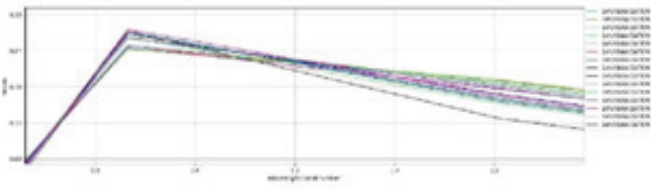

Figure11. Spectral Plot of Urbanization Class

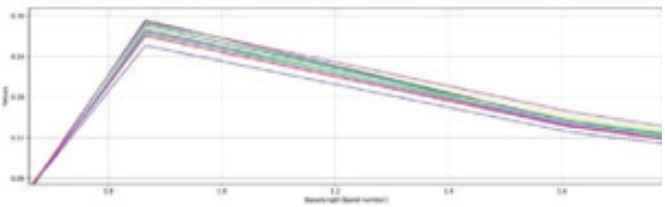

Figure 12. Spectral Plot of WaterBody Class

We have used the 10 VH bands of Sentinel-2 and named it as January to December to know in which month the crop yield is higher. The result which we have got is shown below in Figure 13. And the temporal signature is shown below in Fig 14.

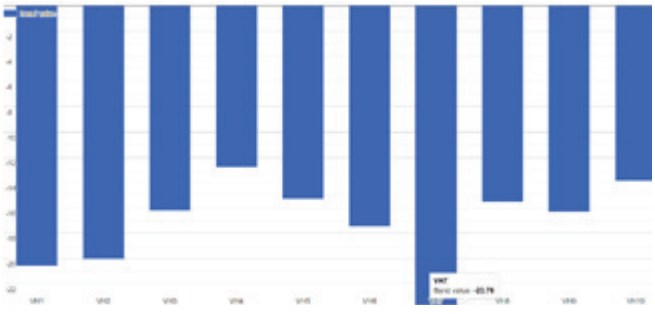

Figure 13. Bands of Sentinel-2

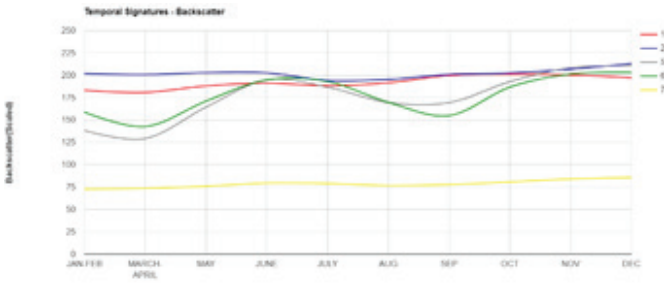

Figure 14. Temporal Signature of Crops

Visualcontrol is basically visual assessment of the results of supervised or unsupervised learning. Once the visual control has passed and if the results look plausible then the quantitative approach for accuracy assessment can be made. Accuracy assessment procedure with the help of error metrics plays a vital role in any classification job and plays a vital role in LULC classification. This is done by calculating the evaluation metrics like confusion matrix, and the kendrapara map generated by minimum distance, SVM and Maximum Likelihood ML models are shown in Fig. 15 through 19 respectively. Then the map generated by crop classification is also shown in Figure 20. We have used the LULC data as test set for the crop classification model and the accuracy we got by applying Random Forest ML model was 97%.

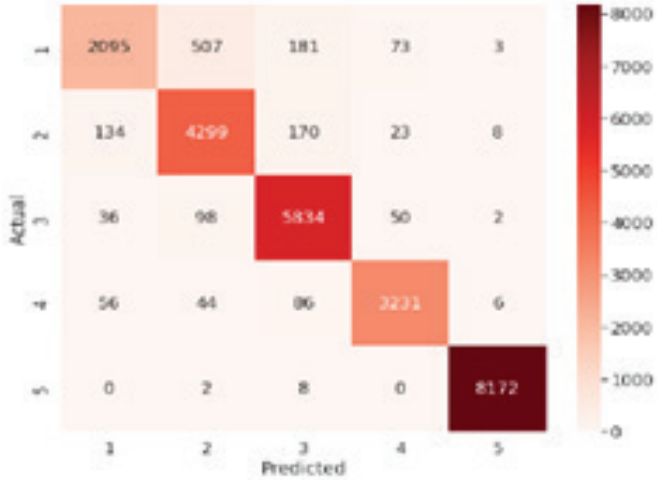

Figure 15. Confusion Matrix of RF

Figure 16. Confusion Matrix of SVM

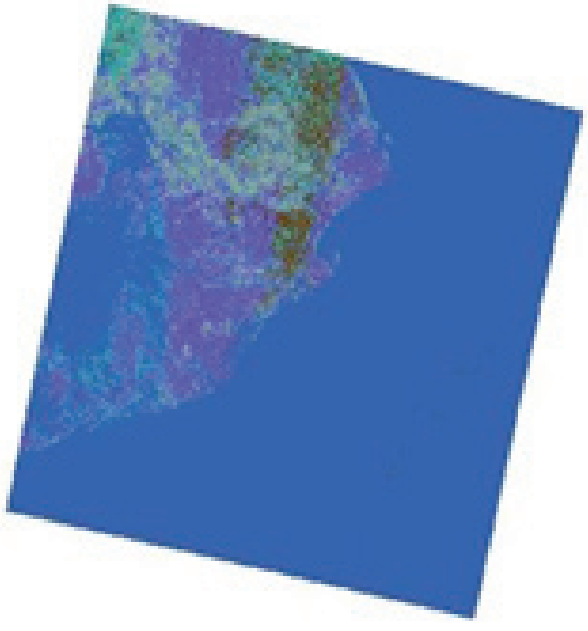

Figure 17.Classified image for LULC by Maximum Likely-hood ML model

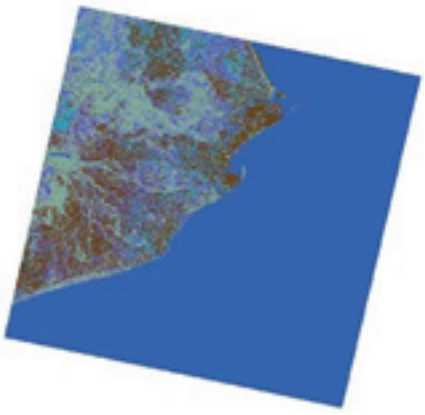

Figure 18.Classified image for LULC by RF ML model

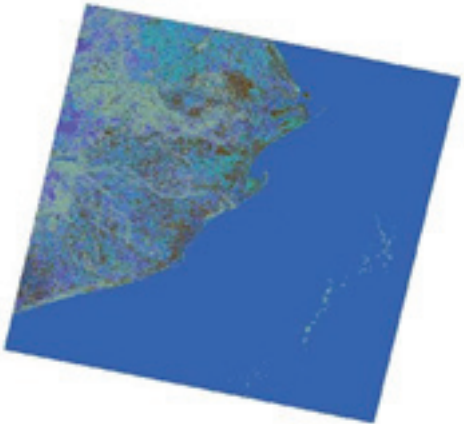

Figure 19.Classified image for LULC by SVM ML model

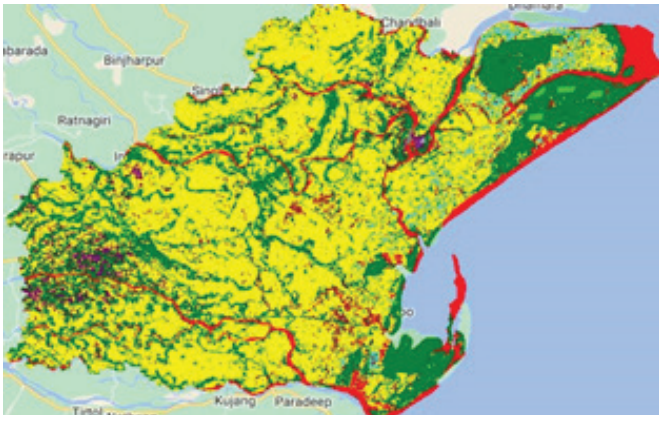

Figure 20. Classified Crop map of Kendrapara

VI. CONCLUSIONS

Land use and land cover classification is beneficial to explore the change dynamics of the city. "Although the Maximum Likelihood classifier is a widely used classifier, it could not perform satisfactorily to ensure the desired classification accuracy. This work presented the pixel-based classification of LULC using various ML models. This will benefit the researcher to recognize the best classifiers and various evaluation metrics. Random Forest shows better performance here. Landsat-8 geospatial data with atmospheric correction significantly improve the accuracy of LULC classification. We have studied all there levant papers for the LULC classification and found that the SVM model works very well in comparison to all the models". But in our study we found that Random Forest ML model gave more accuracy using 100 tree as the parameter. So this paper will be helpful to all the researchers working on the LULC classification domain. As we now know whether or not a crop is produced on our classified crop land, the next step is to determine which crop is produced on that field. In order to obtain the ground truth data for the Kendrapara district, researcher may personally visit an agricultural field and collect data using a high-resolution camera and a drone to determine what crop was harvested at which time stamp. On the basis of each piece of data, an application may be developed in future whose input will be an area of the Kendrapara district and a certain date, and whose output will be the name of the crop harvested in that region on that day.

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Floating solar technology (Source: E&T News)

A floating solar park with nearly 12,000 photovoltaic panels is open in Alqueva Dam of Portugal, Europe. It is a hybrid project in which hydroelectric energy generated by the dam as well as solar panels are floated on top of the dam's water. EDP, the energy company behind the project, plans to construct a total hybrid farm with up to 154 MW of renewable capacity, including 70 MW of floating solar PV, 14 MW of solar overcapacity, and 70 MW of hybrid wind capacity. "Floating solar technology represents a significant step forward in the expansion of renewables and the acceleration of the decarbonisation process," said EDP CEO Miguel Stilwell d'Andrade.

AI techniques to predict cardiac arrest (Source: Indian Express)

A visual diagnosis and deep learning based prediction of heart attack developed by Johns Hopkins. The model is trained on different heart patient history and images of diseased heart with clinical decision making that increases the chances of survival for patients.

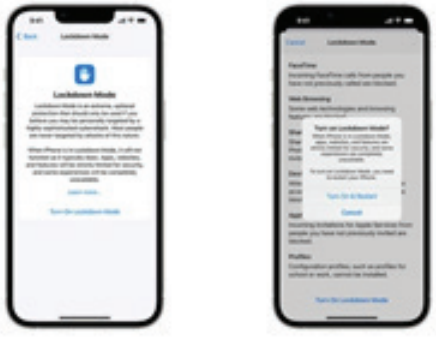
The researchers found that 20% of heart attack death in the world is due to Arrhythmic. Current clinical process extract only scars features like volume and mass whereas the new model can extract critical data. It is found that the models predictions were more accurate on every measure than doctors. The researchers suggest that deep learning concept may be used in other fields of medical science.

CO_2 harvestment (Source: E&T News)

Rail systems around the world could be harnessed to capture carbon dioxide using specially designed trains, researchers from the University of Sheffield have said.

A direct air capture (DAC) equipment can be placed within special rail cars on already running trains to absorb carbon from the atmosphere. The air then moves through a chemical process that separates the CO_2, allowing the rest of it to travel out of the back or underside of the car and return to the atmosphere. This will be helping to mitigate the impact of climate change.

Lockdown Mode in Apple Accessories (Source: Indian Express)



On July 6, tech giant Apple announced that its computers, tablets, and smart phones would shortly feature a new "Lockdown Mode". This is mostly trying to solve privacy concerns. "Lockdown Mode" will restrict most attachments sent to the iPhone's Messages app. When iPhones are locked, the new mode will also prevent wired connections.

Digital support to reduce alcohol consumption. (Source: E&T News)

Researchers have developed a digital tool that they believe could help people reduce their alcohol consumption.

"At the beginning of the study, the participants said it was very important for them to reduce their alcohol consumption. But most said they didn't know how to do it," said Marcus Bendtsen, an associate professor at the university.

According to the researchers, the tools made available assist individuals in setting personal objectives and monitoring their alcohol use over time. Additionally, participants might get more knowledge about the social dangers of drinking while intoxicated as well as the health dangers.

A reminder message that take it easy with the drinking on a particular day or a motivating reminder of why they wished to drink less might be written down and sent to oneself at a time that they prefer.

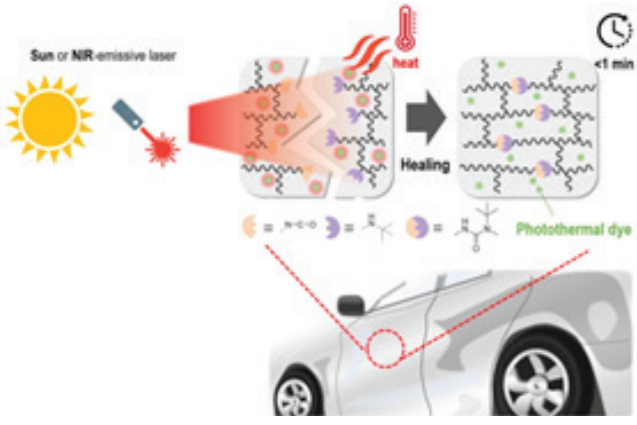
The study team reported that after four months of usage, the impact of the digital support tool was similar to previous digital treatments from worldwide studies, but also marginally superior than the evidence for face-to-face therapies.

Bendtsen explained, "This kind of tool won't change the overall societal situation with alcohol consumption, but it is a very good tool for individuals who want to change their own lives."

Terzan 2 globular cluster in Scorpio constellation (Source: Indian Express)

NASA has released a Hubble Space Telescope image of the globular cluster Terzan 2 in the Scorpio constellation .Globular clusters contain tens of thousands to millions of star clusters that are stable and closely connected. They can be found in many different galaxies. The hearts of the globular clusters are filled with a multitude of sparkling stars. The new Hubble image like the one of Terzan 9 released earlier this year are similiar, however as seen from Earth, they are located in different parts of the sky. Terzan 9 is in the Sagittarius constellation and Terzan 2 is in the Scorpio constellation.

Self-healed coating material for your Vehicle: (Source: E&T News)



A research team from Korea Research Institute of Chemical Technology (KRICT) developed a transparent coating material with excellent durability and performance comparable to commercial protective coating materials, and which can self-heal in 30 minutes when exposed to sunlight.

The surface temperature of the created material increases as sunlight is absorbed because light energy is transformed into thermal energy. The repeated dissociation and recombination of chemical bonds in the polymer structure is then enabled by the elevated surface temperature to self-heal a surface scratch.

The study team combined the commercial coating resin with a transparent photothermal dye and a dynamic chemical bond that can repeat the deconstruction and recombination of the polymer structure such that dynamic chemical bonding happens actively when exposed to sunlight.

Machine Learning Approaches for Biometric Applications

Fingerprint Analysis is the study of fingerprint features and characteristics associated with the captured image. It is a very popular and highly acceptable field of Biometric Applications. It is widely used for personal identification and forensic investigation. Biometric offers new challenges in high-security applications and also supports natural and fast authentication. To achieve this accuracy and speed, fingerprint images need to be analyzed through feature extraction and classification process. So the design of accurate feature extraction and classification technique plays an important role in the identification and matching of a fingerprint image.

Although various researches have already been conducted in this field, still achieving the correct accuracy level with minimum time is the biggest challenge for the researchers. So, there is a strong need for the development of new algorithms in this area to achieve higher identification and classification accuracy. The machine learning algorithms for classification can help to formulate novel classifiers to reach the required accuracy in classification.

In this work, we aim to develop different novel, hybrid machine learning techniques for the classification of real-time fingerprint images. Different machine learning classification and optimization techniques are used here to design the new models.

Here we have created one fingerprint database of real-time images and proposed three different techniques for classification and detection of a fingerprint image. The classification techniques are MLPNN based hybrid classification technique using genetic algorithm (GA-MLPNN) and biogeography based optimization (BBO-MLPNN) algorithms, FLANN based hybrid classification techniques using genetic algorithm (GA-FLANN), biogeography based optimization (BBO-FLANN), and particle swarm optimization (PSO-FLANN) algorithms and FLANN based fuzzified hybrid classification using genetic algorithm (Fuzzy-GA-FLANN) and particle swarm optimization (Fuzzy-PSO-FLANN) algorithms where parameters are fuzzified before optimization. The experimental results obtained in this work prove that the techniques are robust enough to provide higher classification accuracy. Out of these methods, the Fuzzy-PSO-FLANN method proved to provide the best classification accuracy in less execution time for four-class classification of real-time fingerprint images. This research has found novel successful methods for reliable classification of fingerprints in biometric image analysis. These techniques will encourage biometric researchers to classify fingerprints correctly and efficiently and the outcomes may help to detect the identity of individuals with higher accuracy.

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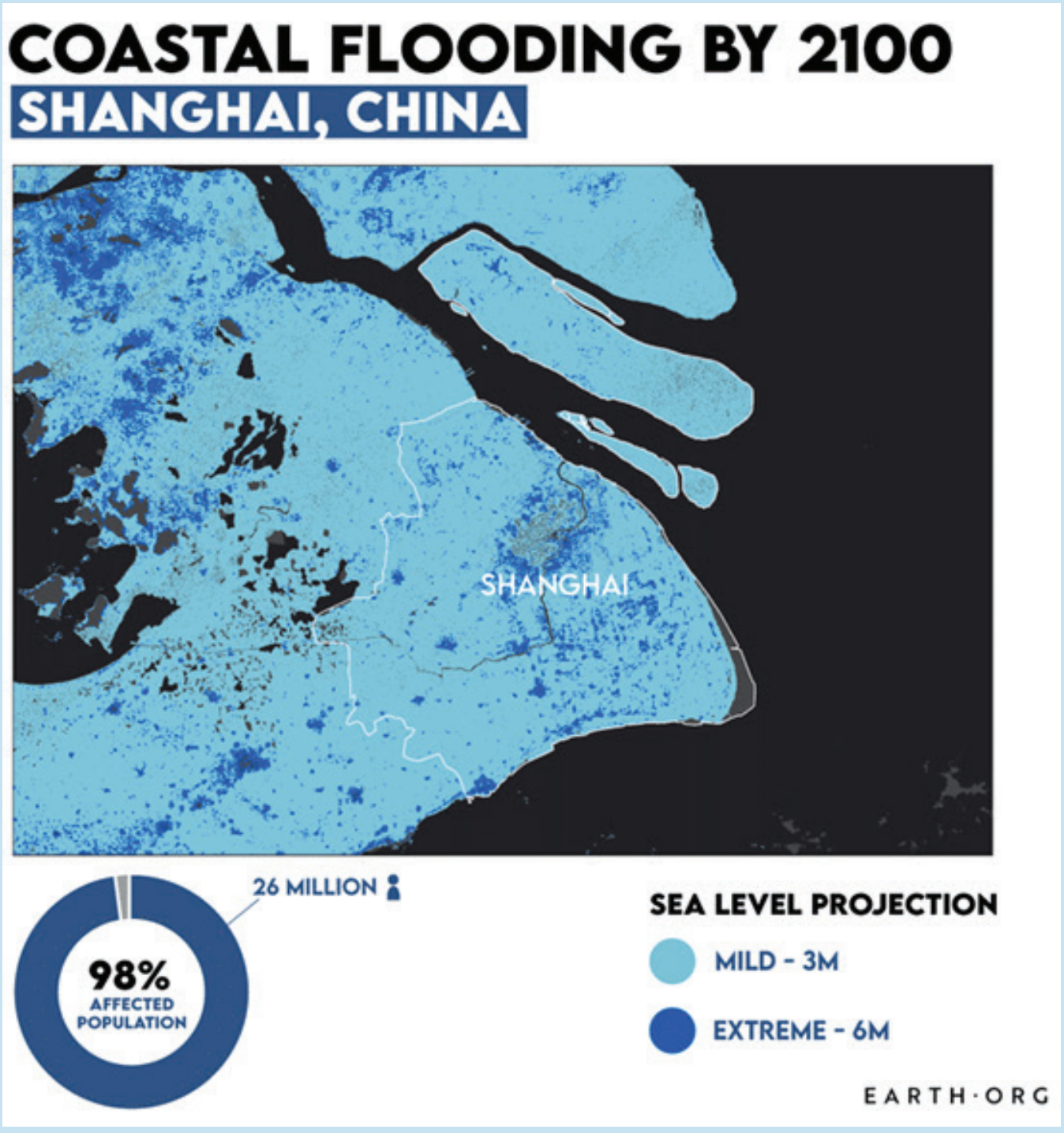
Melting Ice Caps and Sea Level Rise

The climate crisis is warming the Arctic more than twice as fast as anywhere else on the planet. Today, sea levels are rising more than twice as quickly as they did for most of the 20th century as a result of increasing temperatures on Earth. Seas are now rising an average of 3.2 mm per year globally and they will continue to grow up to about 0.7 metres by the end of this century. In the Arctic, the Greenland Ice Sheet poses the greatest risk for sea levels because melting land ice along with the volume expansion of sea water are the main causes of rising sea levels.

Representing arguably the biggest of the environmental problems, this is made all the more concerning considering that last year's summer triggered the loss of 60 billion tons of ice from Greenland, enough to raise global sea levels by 2.2mm in just two months. According to satellite data, the Greenland ice sheet lost a record amount of ice in 2019: an average of a million tons per minute throughout the year, one of the biggest environmental problems that has cascading effects.

If the entire Greenland ice sheet melts, sea level would rise by six metres. Meanwhile, the Antarctic continent contributes about 1 millimeter per year to sea level rise, which is a third of the annual global increase. Additionally, the last fully intact ice shelf in Canada in the Arctic recently collapsed, having lost about 80 square kilometres – or 40% – of its area over a two-day period in late July, according to the Canadian Ice Service. The sea level rise will have a devastating impact on those living in coastal regions: according to research and advocacy group Climate Central, sea level rise this century could flood coastal areas that are now home to 340 million to 480 million people, forcing them to migrate to safer areas and contributing to overpopulation and strain on resources in the areas they migrate to.

Take Shanghai's megalopolis for example, which is built around the low-lying Yangtze river delta. As the fourth most populous city in the world, the flood risk in the area is high due to its geographical position. Any flooding caused by a higher rainfall can potentially be catastrophic in relation to evacuation, water management and property damage. We may be approaching the point of no return regarding global coastal flooding due to climate change.



Source:https://earth.org/the-biggest-environmental-problems-of-our-lifetime/

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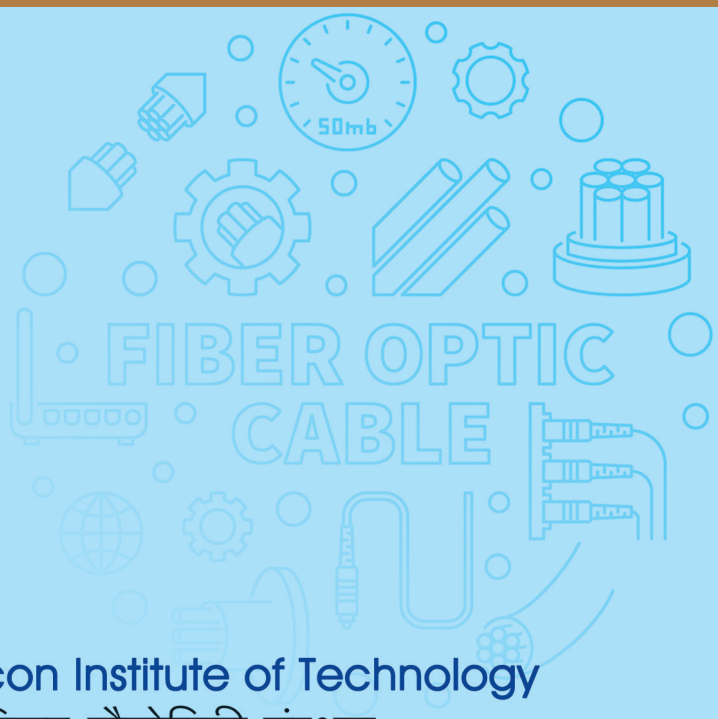
Digital Digest



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