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IOT SYSTEM FOR CAR PARKING, STREET LIGHTS, AND AUTOMATIC IRRIGATION WITH REAL-TIME UPDATES ON MOBILE APP

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Abstract— **In today's energy-conscious world, our foremost duty is to efficiently conserve energy. With advancing technology, automation systems have become the preferred choice over traditional manual methods. We've developed a user-friendly IoT application encompassing smart street lights, a smart parking system, and an automatic irrigation system to ensure effective energy conservation and water reduction. Our IoT-based smart street lights utilize external light sensing to automatically adjust illumination levels, offering 50% and 100% intensity as needed. This minimizes electricity waste and reduces the need for manual control, thus conserving energy. The saved energy can be redirected for residential, commercial, or other essential purposes, contributing to sustainable energy practices. The smart parking system offers convenience to users by allowing them to view available parking slots through the application. Users can make secure online payments, streamlining the parking experience. Additionally, the system aids in locating parked vehicles, enhancing efficiency. Automatic irrigation system employs a distributed wireless network of soil moisture sensors. A gateway unit manages sensor data, triggers, and actuators, transmitting real-time information to a web application. This innovation optimizes water usage in agriculture and landscaping, reducing water wastage and labor. A real-time data, conserving water and time spent on irrigation. This system's ability to adjust water distribution based on soil moisture content ensures efficient water management. Users receive soil moisture information on their mobile devices, promoting responsible water use. By automating processes, reducing waste, and enhancing user experience, we contribute to a more sustainable and energy-efficient future.**

Keywords— **Watermarking, Haar Wavelet, DWT, PSNR**

I. INTRODUCTION

In our rapidly evolving world, characterized by a relentless pace of life, we often find ourselves caught up in the hustle and bustle, leaving little room for small yet impactful everyday tasks. One such task is managing the illumination of our surroundings. Currently, conventional street lighting systems operate on preset schedules, turning on in the evening and switching off in the morning, regardless of actual lighting requirements. This inefficiency results in unnecessary energy consumption and significant financial expenditure. Streetlights are a crucial component of urban and suburban landscapes, yet they often operate at full power, illuminating empty streets. This practice incurs substantial electricity costs and contributes to increased carbon emissions from power generation, posing environmental challenges.

Our initiative introduces an IoT-based Smart Street Light System aimed at conserving energy and reducing manual labor. By incorporating external light sensing, our system adjusts illumination levels based on actual lighting needs, significantly cutting down on electricity wastage. The conserved energy can then be redirected for other essential purposes, promoting energy efficiency.

Furthermore, our Smart Parking System offers an innovative solution to the perpetual problem of finding parking spaces. Through an intuitive mobile application, users can effortlessly identify and reserve available parking slots. This system enhances user convenience, reduces the time spent searching for parking, and streamlines the payment process through secure online transactions. In addition, it employs infrared proximity sensors to detect slot occupancy, ensuring efficient parking management. Beyond urban landscapes, we also turn our attention to agriculture, an indispensable sector for sustenance and economic growth. To optimize crop irrigation, we introduce an Automatic Irrigation System powered by IoT technology. Utilizing a network of soil moisture sensors, our system ensures that crops receive precisely the right amount of water needed for healthy growth. This innovation minimizes water wastage and provides real-time monitoring, enabling efficient water resource management. As we move forward, embracing modern technologies and solutions becomes imperative. Our IoT-based systems not only improve everyday life but also contribute to a sustainable and energy-efficient future. They tackle inefficiencies, reduce energy consumption, and promote responsible resource management, aligning with the global shift towards smart and eco-friendly solutions.

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II. LITERATURE SURVEY

The parking system which exists today differs in vast proportions from the traditional parking systems. The flexibility provided to users has increased tremendously as they can choose their desired slots to park their vehicles. Design and Implementation of a Smart Parking System using IoT Technology at providing a low-cost solution to this problem by creating a Smart Parking Space using the technology of IoT and an inexpensive processor - NodeMCU. A Smart Parking Technology, as such, will help optimize space usage, improve the efficiency of the parking operations and help the smoother flow of vehicles. On the whole, this paper focuses on designing smart parking system, beneficial to both the users and provider in terms of time, fuel and infrastructure. [1]

The System architecture was developed with IR sensor network and MCU. This architecture manages the traffic of the parking area by finding the shortest distance to park the vehicle and therefore helps the users to find the available parking space. [2]

A smart, automated parking system which helps in delaying the car parking difficulties at various places such as railway stations, malls etc. that many people visit with their own vehicles. The drivers use the system to know the availability of slots of the parking area via website. Drivers also have the authority to choose or give their own slots in parking. The various reports of various kinds of management could be improved. Finally, lesser time of the car owner was an added advantage. [3]

A smart parking system has been mentioned for commercial stretch in cities and which can be applied using different database storage systems like cloud, MySQL, python etc. wherein the vehicle is guided to the parking lot using the data which has been collected by sensors, image detectors etc. which is then processed and further sent to the mobile of the user. [4]

Agriculture has a major impact on economy of the country. India’s population is growing rapidly, in parallel to that irrigation area is also decreasing. In order to fulfill the needs, farmers need to grow high quantity of crops with optimum investment. Farmers cannot fulfill this objective with traditional methods of irrigation, thus to overcome this problem we implement Smart Irrigation technique to enhance the growth of crop water management using different sensors. Cost effective solar power can be the solution for all our energy needs. Important aspect of the project is to bring updated farming facilities using IoT. [5]

IoT is used to improve street lighting in a clever way in our time. It is an important factor in solving energy problems and developing street lights around the world. In addition to the study of intelligent street lighting systems we have analyzed and described the different sensors and components used in the IoT environment. [6]

Automatic Street Light Control System is not only simple but also powerful. Relay uses automatic switching on this system. It frees up almost 100% manual labor. As soon as sunlight penetrates the visible surface of our eyes this system automatically changes LIGHT lights. The Light Dependent Resistor (LDR) is a type of sensor that performs this function and senses light as does our eyes. As soon as the light from the sun comes on, our eyes automatically turn off the lights. Such a system is also useful in reducing energy consumption. [7]

Agriculture plays a pivotal role in the nation's economy, with significant research efforts dedicated to automating irrigation systems through wireless sensors and mobile computing. Additionally, there has been considerable exploration into the application of machine learning within the agricultural sector. [8]

Recently, "Machine to machine (M2M)" communication has emerged as a technology, enabling seamless communication between devices and objects. This facilitates data transmission to servers or the cloud via the Core Network. Consequently, we have developed an intelligent IoT-based automated irrigation system. This system involves the collection of sensor data related to soil moisture and temperature, which is then, analyzed using the KNearest Neighbor (KNN) classification machine learning algorithm. This analysis guides the irrigation process, creating a fully automated system where devices communicate and utilize their intelligence for efficient irrigation. Importantly, this innovative system is constructed using cost-effective embedded devices such as Arduino Uno and Raspberry Pi3.[9]

To ensure food security for a growing global population, we must focus on sustainable agriculture, especially in irrigation. Currently, irrigation consumes a significant 85% of the world's freshwater resources. To optimize water usage, we propose an intelligent system that combines Internet of Things (IoT), wireless sensor networks (specifically LoRa), and machine learning. This system leverages soil and weather data to predict crop water requirements. Through the use of machine learning algorithms, it can accurately forecast irrigation needs. Among six tested algorithms, the Linear Discriminant Analysis algorithm stands out with an impressive efficiency rate of 91.25% in predicting irrigation scheduling. [10]

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III. PROPOSED SYSTEM

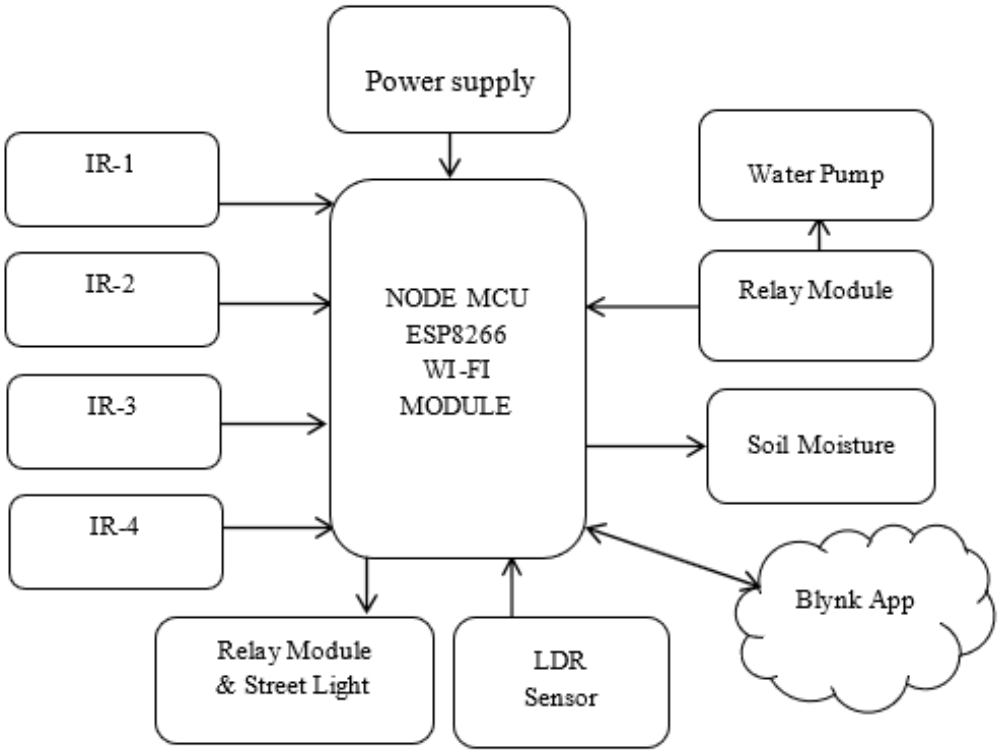

Fig.1: Block diagram

ESP8266: The ESP8266 is a low-cost, Wi-Fi-enabled microcontroller developed by Espressif Systems. It's commonly used for Internet of Things (IoT) and wireless communication projects due to its compact size and builtin Wi-Fi capabilities. The ESP8266 can be programmed using various development environments and supports the use of the Arduino IDE. It has become a popular choice among makers and developers for building connected devices and IoT applications.

Relay Module: A relay module is an electronic device that typically includes one or more relays, each capable of switching electrical circuits on or off. A low-voltage signal, such as from a microcontroller or sensor, triggers the relay module and the relay within the module then connects or disconnects a separate, higher voltage circuit. This capability allows you to control devices like lights, motors, or appliances using a microcontroller.

LDR: An LDR (Light-Dependent Resistor) sensor is a type of passive electronic component that changes its resistance in response to changes in light levels. Also known as a photoresist or, an LDR's resistance decreases as the intensity of incident light on it increases and vice versa. LDRs are often used in streetlights, outdoor lighting, and indoor lighting systems to automatically adjust the brightness based on ambient light conditions. There are two terminals. It operates on 5v DC.

Soil Moisture sensor: A soil moisture sensor is an electronic device designed to measure the moisture content of soil. It provides data on how much water is present in the soil, which is crucial for various applications, particularly in agriculture and gardening. It has four pins like Vcc, Gnd, A0 and D0. it operates on 5v DC.

Water Pump: A 12V water pump is a type of water pump designed to operate using a 12-volt direct current (DC) power supply.

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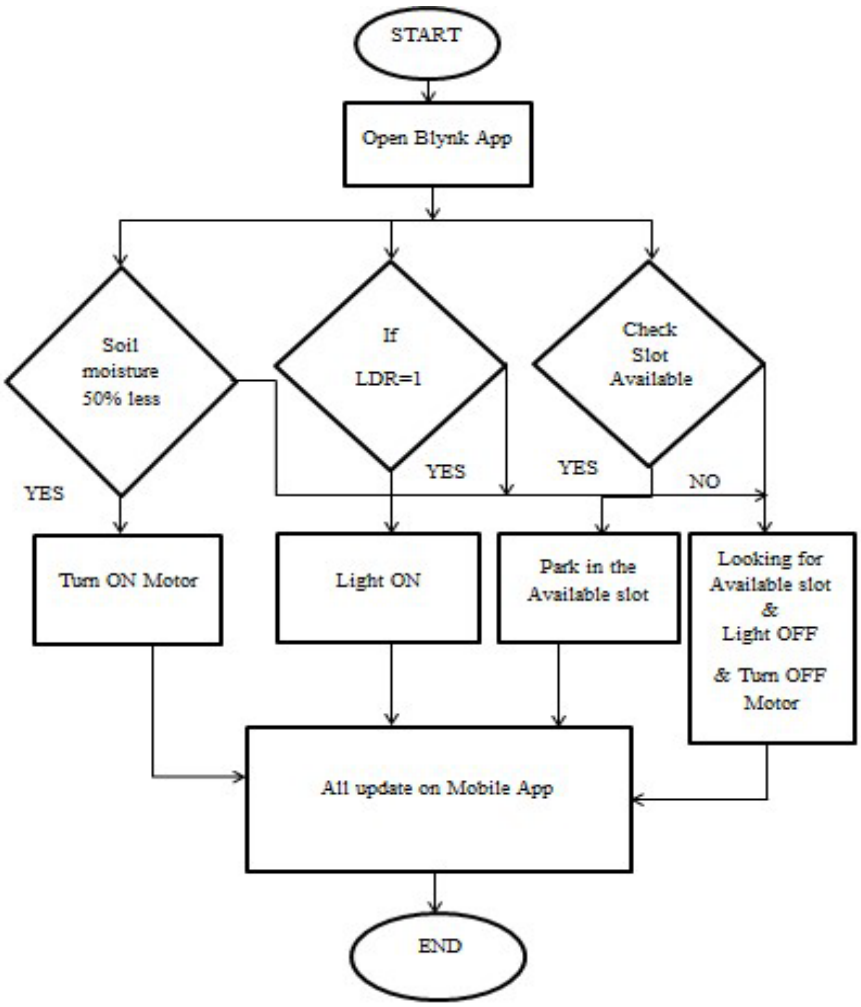
FLOW CHART



ALGORITHM FOR MOBILE APPLICATION

STEP 1: User has to do one-time registration (Sign Up) in the mobile application. Registration requires the following details Email ID and Password. Username (Email ID) and password is also required.

STEP 2: The Users can view the parking slot Empty and occupied the slots for parking. Soil moisture shows by Gauge in the form of percentage (%). Street light is ON/OFF by fire link and shows images.

STEP 3: Users can see the time for the slot while parking. Monitoring the Soil moisture and water motor is ON/OFF.

STEP 4: The slot will be reserved until the user parks the vehicle.

STEP 5: Once the user parks the vehicle timer starts and timer ends when he/she leaves the slot.

STEP 6: Payment will be on the basis of the parked time period.

STEP 7: Payment can be done by online transaction (QR-Scanner).

IV. RESULT & DISCUSSION

230v power supply is given to the step down transformer. Rating of the transformer is 12v. It can be given to bride rectifier which consists of rectifier, filter and a voltage regulator. Rectifier converts the ac into pulsating dc and filter gives the pure dc signal by blocking ripples. The dc voltage is further regulated and it gives 5v dc supply.

There are three main parts: smart car parking, automatic street lights, and automatic irrigation systems. All of these systems provide information that can be updated on the IoT Blynk app. Connect the sensors to ESP8266 to process the sensor data. The microcontrollers continuously monitor the sensors to detect changes in parking space occupancy. The microcontrollers process the sensor data and determine whether each parking space is vacant or occupied. The microcontrollers send the parking space occupancy information to the central server. This data can be transmitted using protocols like MQTT. The central server receives the occupancy data from the microcontrollers. The server stores the data and performs any required analysis or processing.

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Develop a user interface, typically a mobile app where users can view the parking space availability in real-time. The user interface retrieves the occupancy data from the server and displays the status of each parking space, indicating whether it is available or occupied. The system continually monitors the sensor data and updates the parking space status in real-time.
Whenever the sensor detects a low quantity of moisture in the soil, the motor turns on automatically. Hence, will automatically irrigate the field. Once the soil becomes wet, the motor turns off. The system continually monitors the sensor data and updates the soil moisture status in real-time. The proposed system is designed in such a way that during day light time when there is no need of street light, the system will remain in turn off condition even after the system is connected to the power supply. During night time when sun is set, the LDR will sense the intensity of light and sends the signal to microcontroller for turning ON the street lightning system. The system continually monitors the sensor data and updates the LDR sensor status in real-time.
The implementation of the system using the ESP8266 microcontroller module and IR sensor was successful in detecting the presence of vehicles in each parking space. The integration of the Blynk app allowed for real-time notifications to be sent to users' smartphones, providing them with up-to-date information on parking space availability. The system effectively provided real-time monitoring of parking spaces, allowing users to receive immediate notifications when a space became occupied or vacant. The timely notifications facilitated quick and efficient parking spot selection, reducing the time and effort spent searching for available spaces. By informing users about the availability of parking spaces, the system contributed to optimized parking space utilization. It also indicates the duration for which the vehicle has been parked and the associated amount. They can pay and park the vehicles.
Users were able to make informed decisions and find parking spots more efficiently, leading to reduced congestion and improved overall parking management. The integration of the Blynk app enhanced user convenience by providing a user-friendly interface for accessing parking information. Users appreciated the ease of finding available parking spaces and the ability to receive notifications directly on their smartphones, resulting in increased user satisfaction.

Fig.2: Mobile App

Whenever the soil moisture level is decrease, the status indicates a percentage as shown in above figure. When the moisture level exceeds the threshold, the module will output LOW, otherwise, it will output HIGH. This setting is very useful for triggering actions when certain thresholds are reached. For example, when the soil moisture level exceeds a threshold, a relay can be activated to start pumping water. In the above figure, it shows the status of the street lights. During daylight hours when street lighting is unnecessary, the system will remain turned off it means status off. No yellow light blink. Parking -2 is occupied for time is 43 and amount is 4. Payment formula is Time x 0.1 = Payment amount. According formula 43 x 0.1= 4 Rs.

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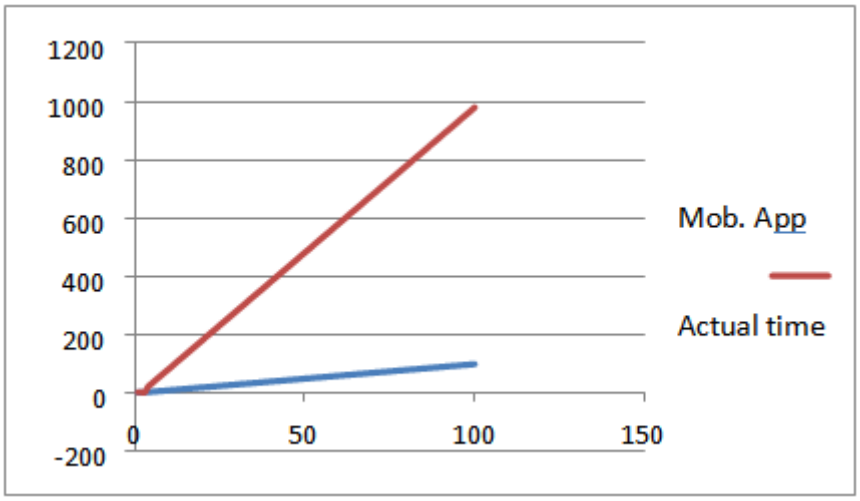
Table 1: Parking Status

Sr. No.	Parking-1 Status	Time-1 (Sec)	Amount-1 (Rs.)	Parking-2 Status	Time-2 (Sec)	Amount-2 (Rs.)
1	Occupied	450	45	Empty	0	0
2	Occupied	150	15	Occupied	700	70
3	Occupied	100	10	Occupied	500	50
4	Empty	0	0	Occupied	780	7
5	Occupied	345	35	Occupied	900	90

Table 2: Parking Status

Sr. No.	Parking-3 Status	Time-3 (Sec)	Amount-3 (Rs.)	Parking-4 Status	Time-4 (Sec)	Amount-4 (Rs.)
1	Empty	0	0	Empty	0	0
2	Occupied	756	76	Occupied	850	85
3	Empty	0	0	Occupied	457	45
4	Occupied	483	48	Occupied	452	45
5	Occupied	465	47	Empty	0	0

Table 3: Mobile App timer vs. actual timer



A system accuracy of 96% is a measure of how well a system performs in correctly classifying or predicting outcomes in a given task or dataset. It indicates that the system is accurate in its predictions or classifications 96% of the time.

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Table 4: Parking Status

Sr. No.	Soil Moisture Status (%)	Motor Status
1	50	OFF
2	40	ON
3	35	ON
4	86	OFF
5	78	OFF
6	39	ON
7	100	OFF

V. CONCLUSION

In conclusion, our IoT-based solutions for smart street lighting, parking management, and agricultural irrigation represent a significant step towards a more efficient, sustainable, and technologically advanced world. Our Smart Street Light System addresses the inefficiencies in traditional lighting by adjusting illumination based on realtime needs, leading to substantial energy savings. This not only reduces electricity costs but also mitigates the environmental impact associated with energy production. The Smart Parking System revolutionizes the parking experience, offering users convenience through a mobile application. By efficiently managing parking spaces and automating payment processes, we alleviate traffic congestion and enhance urban mobility. In the agricultural sector, our Automatic Irrigation System improves crop cultivation by providing precise and timely watering. This not only conserves water but also boosts crop yields, contributing to food security and sustainable agriculture. As we navigate the challenges of a rapidly changing world, our IoT solutions exemplify the potential of technology to enhance our lives while addressing critical energy and resource conservation issues.

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