EMBEDDED IoT BASED SMART PARKING AND ENERGY MANAGEMENT SYSTEM FOR SMART CITIES

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ABSTRACT

The installation of an IoT module on-site is required for the proposed Smart Parking system in order to track and notify the availability of each specific parking space. Users can check the availability of parking spaces and reserve one using a web application as well. There is an Internet of Things device with sensors and microcontrollers in every parking space. The user can select the best parking spot after receiving a real-time update on all of the spaces' availability. Our suggested approach investigated the technologies underlying the smart parking solution using a product developed internally.

Keywords: - *IoT, Digital Key, Microwave Radar sensor, Proximity sensor*

1. INTRODUCTON :

IoT, an emerging technology, is used to explain how internet-connected data collecting equipment like sensors and communication devices are connected. This configuration is used to create an embedded network, a

type of network. Information or data can also be acquired through interacting with sensors in the immediate area. The three different categories of IoT devices are smart sensors, user devices, and gateways. The user data has its own sensors that enable it to gather data and produce information.

The term "Internet of Things" (IoT) describes actual things (or collections of such objects) that have sensors, processing power, software, and other technologies to connect and exchange data with other systems and devices over the Internet or other communications networks. Because devices must be connected to a network and reachable individually rather than the general internet, the phrase "internet of things" has been regarded misleading.

The suggested system employs an ESP32 microcontroller to process sensor data. This system consists of a servo motor, an inductive proximity sensor, an RFID reader, and a microwave radar sensor. Data from the sensors is gathered by the microcontroller, processed, and sent to Thingspeak where it is kept in spreadsheets for analysis. When the parking lot is full, the 20x4 LCD Display will say "No Parking Lots Available."

2.SYSTEM IMPLEMENTATION:

Figure 1 depicts the block diagram of an IoT-based smart parking management system. The system's processing unit, an ESP 32 microcontroller, is the main component. Our model's basic operation is to draw electricity from the smps and distribute it to all of the units. Here, we are employing an ESP32 Microcontroller, a 32-bit controller that gathers data from all the devices and the sensors.

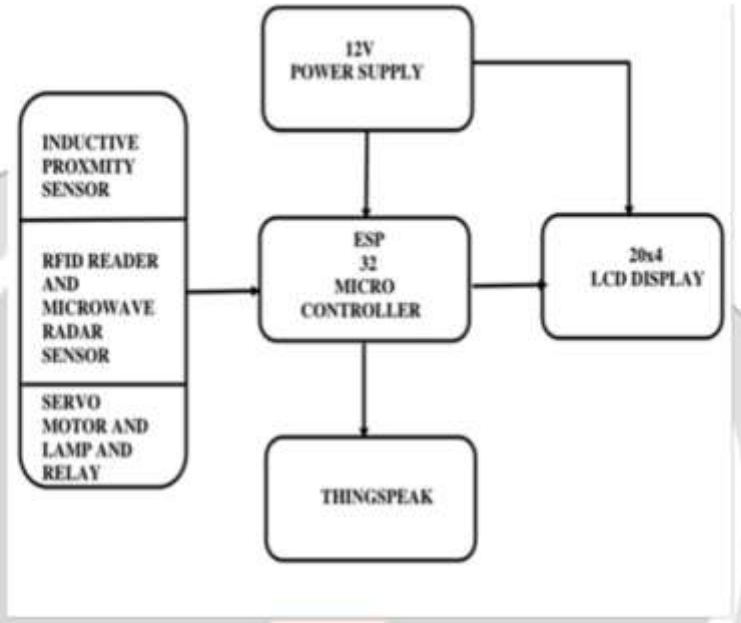

Fig-1: Block Diagram of the proposed system

In this Proposed system proximity sensor used to find any available parking spaces in the parking lot. Traffic congestion at the parking lot Entry/Exit will be lessened using RFID cards under the supervision of the Entry/Exit proximity sensor. In order to collect a fee based on membership at the parking lot, their parking fee bills will be automatically charged based on the points acquired according to the time.

Utilizing an RCWL-0516 Microwave Radar Sensor to track vehicle movement, high beam headlights will turn on when there are vehicle movements, and low beam headlights will turn on in the absence of vehicle movement. 20 segments of columns and 4 rows of data output are shown on a 20 by 4 LCD I2C. When a car is moved without an RF ID card, a servo motor-based nail bed will be activated as a method of theft prevention. The vehicle's tyre will be punctured by a servo motor that will be activated. A web application is a tool for remote monitoring that allows users to keep tabs on what's going on in a parking lot. High/Low beam light is controlled by a two step lamp relay.

2.1 ARDUINO ESP -32 :

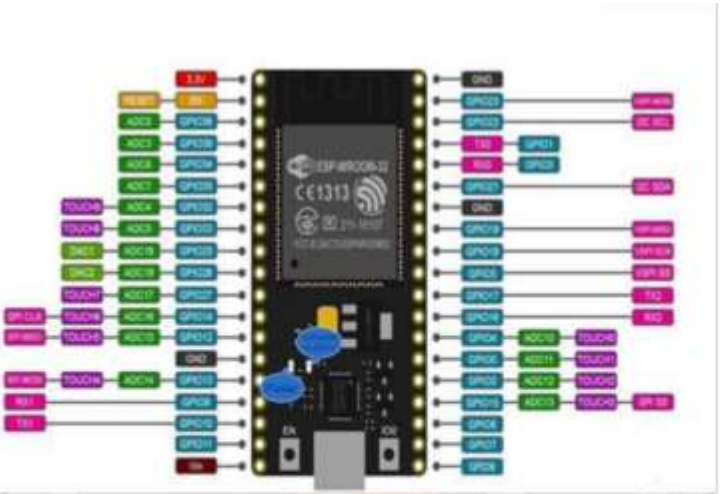

Fig – 2.1: Arduino ESP 32 WROOM32Pin Configuration

The system's processing unit, an ESP 32 microcontroller, is the main component.The microcontroller receives input from sensors including an RFID reader, an inductive proximity sensor, and a microwave radar sensor. The ESP 32 microcontroller analyses the activities of these sensors' outputs, and the controller's analysis is relayed into the Thingspeak app.

Although the ESP32 has 48 GPIO pins in total, only 25 of them are separated off to the pin headers on the development board's left and right sides. These pins can be used for a variety of auxiliary tasks, such as: 15 12-bit SAR ADC channels on ADC channels. Firmware settings for the ADC range include 0-1V, 0-1.4V, 0-2V, and 0-4V.Two UART connections are available. Code is loaded serially using one. They also support IrDA and have flow control. 25 channels of PWM pins, or 25 PWM outputs, for controlling motors or dimming LEDs. 8-bit DACs with 2 DAC channels generate real analogue voltages.SPI, I2C, and I2S interfaces are available. There are three SPI interfaces, one I2C interface, and two I2S interfaces if you wish to add sound to your project. Capacitive touch sensing is available on 9 GPIOs, or 9 touch pads

2.2 INDUCTIVE PROXIMITY SENSOR :

Fig -2.2: Inductive Proximity Sensor

The parking lot's inductive proximity sensor will detect any open spaces for parking. Using RFID cards under the Entry/Exit proximity sensor's supervision, traffic congestion at the parking lot Entry/Exit will be reduced. The inductive proximity sensor allows for the non-contact detection of metal objects up to a distance of 60 mm. In essence, they are made up of an oscillator whose windings serve as the sensing face. In front of these windmills, an alternating magnetic field is produced.

2.3 MICROWAVE RADAR SENSOR :

Fig – 2.3: Pin configuration Microwave Radar sensor

The primary purpose of the RCWL0516 microwave distance sensor is to replace PIR sensors, which utilise IR light produced by moving people. As a result, this type of sensor employs the Doppler Effect technique to detect moving objects. A distance sensor's primary purpose is typically to measure the target distance by sending high frequencies. Ultra-high frequency (UHF) and very high frequency (VHF) bands are available for electromagnetic waves like microwaves and are used for communication. Short microwaves are mostly utilised in detecting devices like radars, alarm systems, and human body detectors.

The RCWL-0516 is a tiny proximity sensor that detects intrusions using Dopler Radar. It can be used independently or in conjunction with a microcontroller or microcomputer and is very adaptable. Electromagnetic radiation is used by a microwave motion sensor. It sends out waves, which the receiver subsequently receives by way of reflection. The waves that are reflected back are examined by the receiver. These waves will change if there is a moving object in the room. Using the RCWL-0516 microwave radar sensor, this proposed model will track the movements of cars, activating the high beam headlight when there are movements and the low beam headlight otherwise

3.CONCLUSIONS:

The "EMBEDDED IoT BASED SMART PARKING AND ENERGY MANAGEMENT SYSTEM FOR SMART CITIES" has undergone successful testing and implementation. This mechanism guarantees that the smart parking systemoperates at its highest capacity. The system produces accurate reports, increasing the system's effectiveness. The suggested strategy guarantees that a smart parking system is put in place as soon as practicable. the use of sensors and a wireless link to keep track of how many parking spaces are available overall. As a result, there is less traffic in the city, safe and secure parking, and reduced time consumption.

Future smart city officials may be able to transmit information with ease and maintain system performance by performing real-time monitoring of the smart parking system utilising GPS and MQTT (Message Queue Telemetry Transport)..

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