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# Implementation Of Internet Of Things For Development Of Smart Colonies

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***Abstract*:** The quick and substantial growth of the housing industry demands the need to integrate technology into one's day to day life. As the need to improve the quality-of-life increases, the products used for the same also increases. This results in cluttering of devices and it becomes a tedious task to control and monitor all of them. This project aims to develop an automated system which enables the users to have access and control over day-to-day appliances that would otherwise go unchecked. To accomplish our goal, we use a system of sensors and actuators which are operated by a microcontroller which in-turn will monitor the sensor data with the help of Internet of Things. This system can also automate certain appliances for specific applications as per the user's need. This project focuses on the development of a colony but it has the scope to extend to an entire society. The colony residents can access their relevant data through the IoT platform ranging from their home data to colony alerts.

***Index Terms* – Internet of Things, Microcontroller, sensors, automate**

## I. INTRODUCTION

Internet of Things is a network of physical objects that are embedded with sensor, software and other technologies for the purpose of connecting and exchanging data with other devices and systems over the internet. It is mainly helpful in making the lives of the human beings. There is no limit to the potential of IoT in the future. It is capable of automating a variety of business processes by enabling billions of devices simultaneously. Intelligent machines are altering the way people work, where they work, and when they work. The Internet of Things (IoT) features a network of machines, people, data, and processes that connects everything - from machines to people to data - that is now influencing the way that we live our lives in the real world. Generations build on generations, and we can look back into past homes as a way to peek into the personalities, values, and ambitions of previous generations. The home is the first place where we create our identity and mark our place in the world-our original profile. The Internet of Things (IoT) enables internet-connected, electronic control of household appliances. Using a mobile app, these systems can be coordinated by a central hub and controlled remotely through a mobile app to perform heating and lighting arrangements in advance. It seems like there are new smart home products being released every day. But behind each of these products is a new smart device connected to a new app on your smartphone, with a new remote to control it. As a result of the Internet of Things, we can do our work much better and have less time-consuming tasks. And no matter how helpful any of these devices might seem, nobody can predict how long these devices will last.

## II. METHODOLOGY

### 2.1 Lighting:

The proximity sensor and LED lighting system is designed. The IR Proximity Sensor is a multifunctional infrared sensor that can be used as an encoder sensor as well as for obstacle sensing, color detection, fire detection, line sensing, etc. A digital output is provided by the sensor. When an object is placed in front of the sensor, the sensor outputs a logic one (+5V) at the digital output; when nothing is in front of the sensor, the sensor outputs a logic zero (0V). The existence of an object is signaled via an internal LED. When an electric current passes through a semiconductor device called a light-emitting diode (LED), the LED emits light.

### 2.2 Air conditioning:

In the air conditioning module, we employ room counting technology to identify the person's presence and a DHT-11 temperature sensor to track the ambient temperature. The widely used DHT11 temperature and humidity sensor has an integrated NTC (Negative Temperature Coefficient) for temperature measurement and an 8-bit microprocessor for serial data output of the temperature and humidity values. With an accuracy of 1°C and 1 percent, the sensor can measure temperature from 0°C to 50°C and humidity from 20% to 90%. The DHT11 sensor comprises of a thermistor for measuring temperature and a capacitive humidity sensing device. The DHT-11 sensor will continue to monitor the temperature and regulate the fan speed to maintain the appropriate temperature.

**2.3 Water tank level monitoring**:

An ultrasonic sensor is used in the water tank monitoring module to measure the water level in the tank. An ultrasonic sensor is a sensor that uses ultrasound, which travels through the air, to measure distances. The ultrasound will bounce back in the direction of the sensor if it encounters a wall or other obstruction on its way. When an object or obstruction gets in its way, the ultrasonic it generates at a frequency of 40 000 Hz will bounce back to the module. You can determine the distance by taking into account the sound's speed and travel time. The sensor is positioned at the top of the water tank, pointing downward. We can accurately identify the water level because the detection is analogue. The user can access the cloud data through the user interface.

**2.4 Gas leak detection:**

A MQ-5 sensor is used by the gas leak detection module to identify gas leaks and sound the buzzer. This sensor is a gas-leakage sensor used to find combustible gases like propane, LPG, and ethanol fumes. The sensor has a $SnO_2$ sensitive filament. This filament often has a reduced electrical conductivity when there is clean air present. The conductivity of the filament increases when a flammable gas, such as LPG, is supplied, and the degree of change in conductance/resistance can be utilized to calculate the equivalent gas concentration. A gas leak would be indicated if the gas concentration in the kitchen increased above a specific point. Piezoelectric sounders are audio components that produce audio that may be used as input signals (including multi-tone, melody, and other types of signals) without having built-in oscillation circuits. The piezoceramic element diametrically expands and contracts as an alternating voltage is given to it. The ceramic plate is made to vibrate quickly to produce sound waves using this property of piezoelectric material. This buzzer will sound when there is a gas leak, and the IoT system will alert the local authorities.

**2.5 Sprinkler automation:**

The soil moisture sensor is used by the sprinkler automation module to operate the sprinkler pump. The Soil Moisture Sensor measures the resistance between two metallic probes that are put into the soil to be monitored in order to calculate the quantity of soil moisture present. Two probes make up the soil moisture sensor, which measures the volumetric content of water. The soil is passed through by the two probes, which subsequently provide the resistance value needed to calculate the soil's moisture content. There will be less resistance when there is more water in the soil because the soil will conduct electricity more readily. As a result, there will be more moisture present. Less water indicates that the soil will conduct less electricity, which will result in more resistance because dry soil conducts electricity poorly. The moisture content will consequently be decreased. The pump is activated until the sensor resistance returns to normal when it exceeds a particular threshold. The moisture level regulates a DC motor that powers the pump.

**2.6 Parking space:**

The room counting system is part of the parking space module, which counts the number of available automobiles. When a car pulls out of the parking lot, the number of empty spots increases, and when a car pulls in, the number of spaces decreases by one. On a 16x2 LCD, this may be seen. With a 16x2 LCD, there are 2 lines that can each display 16 characters. Each character on this LCD is presented using a 5x7 pixel matrix. The liquid crystal molecule tends to untwist when an electrical current is given to it, which is the basic idea underlying LCDs. As a result, the angle of light travelling through the polarized glass molecules and the angle of the top polarizing filter alter. As a consequence, a little amount of light is permitted to flow through a specific portion of the LCD's polarized glass. Arriving motorists will be able to check the parking lot for available places before entering thanks to the LCD display. The data is delivered to the cloud in addition to LCD display, allowing the user to inspect the colony for open spaces through the user interface.

**2.7 Garbage disposal:**

An ultrasonic sensor is used by the waste disposal module to determine if the trash can is full. Ultrasound, which passes through the air, is used to estimate distance. The ultrasound will bounce back in the direction of the sensor if it encounters a wall or other obstruction on its way. It is positioned facing down in the upper portion of the trash can. The microcontroller receives a signal when the garbage level reaches a predetermined level and tells the authorities to empty the bin. Garbage disposal would be incredibly effective as a result.

**2.8 Night lights**:

To turn on the street lights at night, the night light module uses LDR sensors. The LDR sensor is used to measure light intensity. The Photo-resistor Sensor is another name for this sensor. An internal LDR (Light Dependent Resistor) on this sensor aids in its ability to detect light. The LDR resistance will drop and the element conductivity will increase as the light intensity increases on the LDR surface. The LDR resistance will rise and the element conductivity will fall as the light intensity decreases on the LDR surface. The signal is provided to the microcontroller when the electrical conductivity rises over a specified threshold. As a result, the lights turn on at night. As the LDR conductivity falls during the day, the microcontroller is activated. The light is consequently switched off.

## III. FABRICATION AND RESULT

**3.1 Preliminary Design:**

We had taken the design considerations for the project and the objectives that needed to be achieved. From there, we designed the system to meet all of its application and came up with a preliminary design for the project. The fabrication of this project was done by selecting the size of the smart colony, about 1200x750 mm². We had laid all the structures to simulate the colony and to mount all of the sensors and actuators. As visible in the photographs, the working model was completed with expected results. To achieve this, we had gone through different phases of fabrication.

**3.2 Specification research:**

As the functional requirements were discussed in the previous segment, this segment delved more into the components required for this project. Our prototype had to have the right sensors and actuators that are scalable in the real world. The microcontrollers used were Node MCU ESP 8266 for digital data and ESP 32 for analog data. Subsequently, the sensors were chosen to be compatible with these boards.

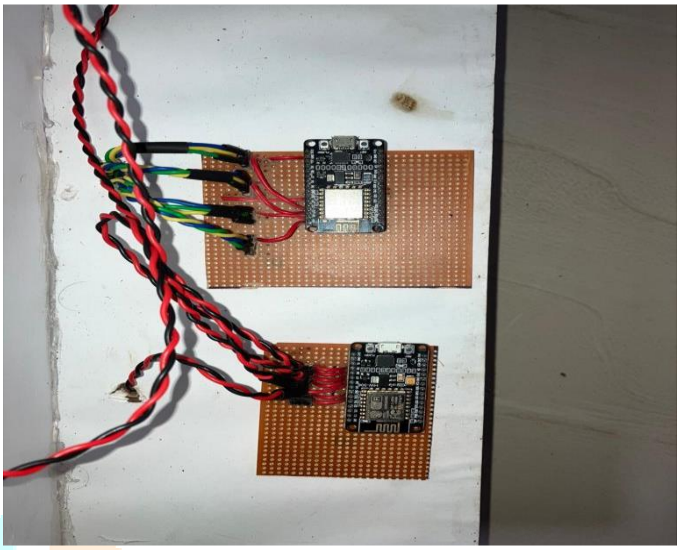

Fig. 3.2.1: Node MCU ESP 8266

**3.3 Design and simulation of modules:**

Each function that had to be performed required a different sensor and data processing. Based on the requirements, the designs for these individual systems were simulated in TinkerCAD using the components available in the site and coding in C.

**3.4 Fabrication and testing of modules:**

Once the simulations were done, the next step was to upload the code to the microcontroller and do the necessary connections with the sensors. We used Arduino IDE to code in C language and uploaded the code to the microcontroller. The output could be seen through the serial monitor which could be used to detect discrepancies regarding the code.

**3.5 Module Integration:**

We used each of the boards to perform several actions. Initially we had tested for each action separately, but we had to test the board with multiple sensors connected to it. We had kept the functions on a loop in the program and reduced unnecessary delays for a faster response.

**3.6 Offline Testing:**

Once all the modules were integrated, we tested the smart City system without any internet support. The data was observed through the serial monitor where all the microcontrollers were running performing all of its functions simultaneously.

**3.7 IoT Testing:**

Once the offline testing was done, the IoT testing had to take place where we use a Wi-Fi client to access the internet. The IoT platform we had used was Google Firebase because of its simplicity in regards to app compatibility. The microcontroller would process the data and send it through the cloud where we could see the database values change.

**3.8 Designing user interface:**

The data is readily available on the database, but is not accessible to the common user. So we created an app-based user interface where all the relevant data would be available to the users. To make the application, we used MIT App Inventor which is an online platform to graphically code applications. We had designed the app to be used by the colony members with each user having a unique login id and password. This would allow only that particular user to receive the data relevant to their houses and the surrounding while keeping their data safe from prying eyes.


Fig. 3.8.1: App log-in.

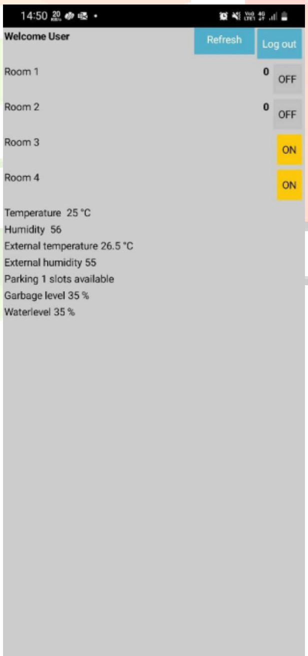


Fig. 3.8.2: Sensor data shown on the app.

### 3.9 Final Fabrication:

For the final fabrication, we fabricated the model to completion and installed all the components and boards to it and made the wiring for the sensors and actuators. We then dumped all the code to the relevant boards and powered them all up. The project was running with all the objectives achieved and the data being readily available to the user from any part of the globe.

Fig. 3.9.1: Final Model of the colony.

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