SMART CAMPUS : A DIGITAL TRANSFORMATION USING INTERNET OF THINGS

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ABSTRACT

This paper presents a proposal for a smart campus with the integration of RFID technology for smart attendance, smart classrooms to save power, and water level control for efficient water management. The proposed system utilizes RFID tags to identify and record the attendance of students and staff automatically, eliminating the need for manual attendance taking. The smart classroom system includes sensors that detect the occupancy and adjust the lighting and temperature accordingly to save energy. The water level control system uses sensors to monitor the water level in tanks and control the flow of water, preventing wastage and ensuring optimal use of water resources. The proposed smart campus solution provides a sustainable and efficient approach to campus management, reducing operational costs and promoting environmental sustainability.

INTRODUCTION

Campus management is an essential aspect of the smooth functioning of educational institutions. However, traditional campus management practices are often manual, time-consuming, and inefficient. With the advancements in technology, the concept of a smart campus has emerged, which offers a sustainable and efficient approach to campus management.The proposed smart campus integrates three key features, namely smart attendance using RFID technology, smart classrooms to save power, and water level control for efficient water management. The smart attendance system uses RFID tags to automatically record attendance, eliminating the need for manual record-keeping and providing accurate attendance records.

The smart classroom system includes sensors that detect the occupancy and adjust the lighting and temperature accordingly, reducing energy consumption and improving the learning environment. The water level control system uses sensors to monitor the water level in tanks and control the flow of water, preventing wastage and optimizing the use of water resources.
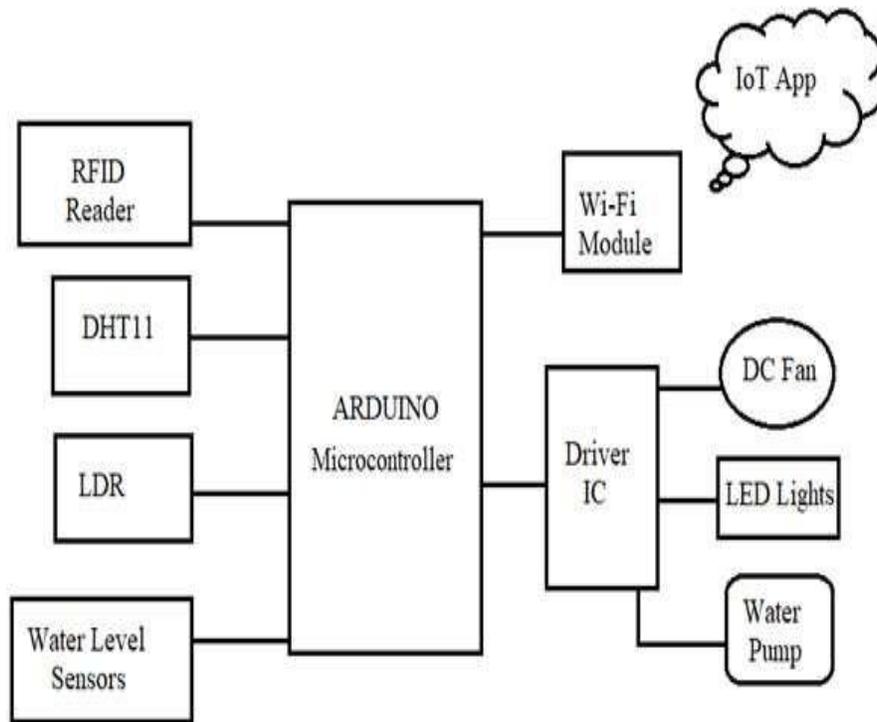
Fig.1: BLOCK DIAGRAM

The Arduino Uno is a microcontroller board based on the ATmega328 (datasheet). It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz crystal oscillator, a USB connection, a power jack, an ICSP header, and a reset button. It contains everything needed to support the microcontroller; simply connect it to a computer with a USB cable or power it with an AC-to-DC adapter or battery to get started.

The Uno differs from all preceding boards in that it does not use the FTDI USB-toserial driver chip. Instead, it features the Atmega8U2 programmed as a USB-to-serial converter. "Uno" means "One" in Italian and is named to mark the upcoming release of Arduino 1.0. The Uno and version 1.0 will be the reference versions of Arduino, moving forward. The Uno is the latest in a series of USB Arduino boards, and the reference model for the Arduino platform; for a comparison with previous versions, see the index of Arduino boards.

The Arduino Uno can be powered via the USB connection or with an external power supply. The power source is selected automatically. External (non-USB) power can come either from an AC-to-DC adapter (wall-wart) or battery. The adapter can be connected by plugging a 2.1mm centre-positive plug into the board's power jack. Leads from a battery can be inserted in the Gnd and

Vin pin headers of the POWER connector. The board can operate on an external supply of 6 to 20 volts.

PROPOSED SYSTEM

The Internet of things (IoT) is the network of everyday objectsphysical things embedded with electronics, software, sensors, and connectivity enabling data exchange. Basically, a little networked computer is attached to a thing, allowing information exchange to and from that thing. Be it lightbulbs, toasters, refrigerators, flower pots, watches, fans, planes, trains, automobiles, or anything else around you, a little networked computer can be combined with it to accept input (especially object control) or to gather and generate informational output (typically object status or other sensory data). This means computers will be permeating everything around us ubiquitous embedded computing devices, uniquely identifiable, interconnected across the Internet. Because of low-cost, networkable microcontroller modules, the Internet of things is really starting to take off.One Arduino Uno is placed at the central location where it can receive data from various sensors and devices and connected to Wifi module,which allows to transmit the data to database.RFID EM18 reader is typically connected to the Arduino Uno through a UART interface. The TX pin of the RFID EM18 reader is connected to one of the RX of the Arduino Uno which acts as a serial receive pin. The Arduino Uno communicates with the RFID EM18 reader using the SoftwareSerial library to read the RFID tag data.The DHT11 sensor communicates with the Arduino through a single-wire digital interface. DHT11 data pin is connected to a digital pin 5 on the Arduino boardThe LDR which is an analog sensor, connected to the analog pin A0 of the Arduino board. Out of two float sensors,One leg of each sensor connected to GND pin of Arduino. Other leg of first sensor and second sensor connected to digital pin 2 and pin 3 of Arduino.In driver IC ULN2003,Pin 1 is connected to digital pin 8 of the Arduino, pin 2 to digital pin 9, and pin 3 to digital pin 10.Pin 8 is connected to GND, and pins 9 to 12v are connected to a power source.Pin 14 is connected to LDR strips and pin 16 is connected to a DC fan to control lighting and temperature in the classroom.,while pin 15 is connected to a DC water pump to maintain the water level in the tank.

CIRCUIT DIAGRAM
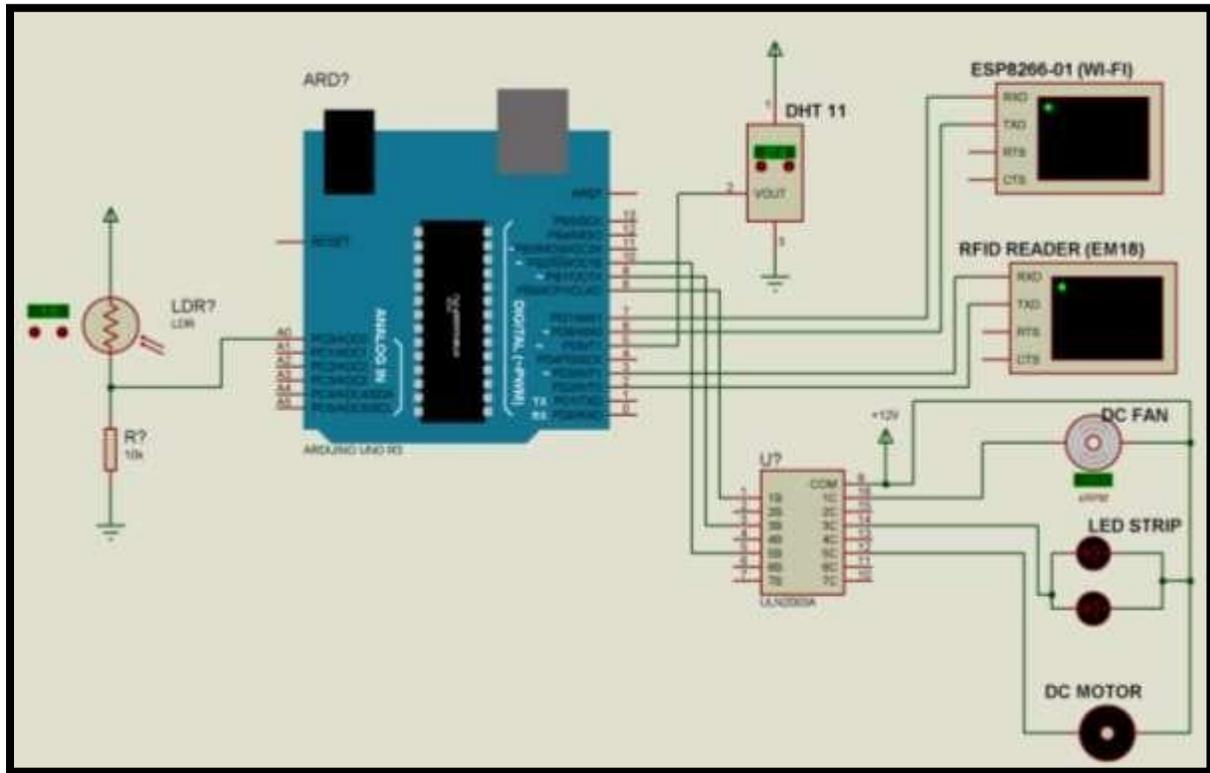
- When a student swipes their RFID card or tag, the EM18 reader reads the unique ID and sends it to the Arduino Uno. The Arduino Uno checks the ID against the list of IDs stored in its memory. If the ID matches with the list, the attendance of that particular student is marked as present and a sound is emitted to indicate that the card has been read. If the ID does not match with the list, the attendance is marked as absent.

- The DHT11 sensor measures temperature and humidity and sends the data to the Arduino through the data pin. The Arduino compares the data with set threshold values for the classroom and sends a signal to the ULN2003 to turn on/off the DC fan. The ULN2003 acts as a switch to control the power supply of the DC fan.

- The LDR measures the light levels in the classroom and sends data to the Arduino,which then uses this information to control the ULN2003 driver IC, which in turn controls the LDR strips.

- The two float sensors to monitor the water levels in a tank . When the water level in the tank drops below a certain level, the Arduino Uno activates the water pump by sending a high signal to the driver IC, which provides the necessary voltage and current to the pump. Similarly, when the water level in the reservoir drops below a certain level, the Arduino Uno turns off the water pump by sending a low signal to the driver IC, preventing the pump from running dry.

- The ESP8266 WiFi module is used to connect the system to the internet, and it is connected to the serial communication pins of the Arduino microcontroller. The ThinkSpeak app is used to monitor the status of the classroom, and it is connected to the internet through the WiFi module.
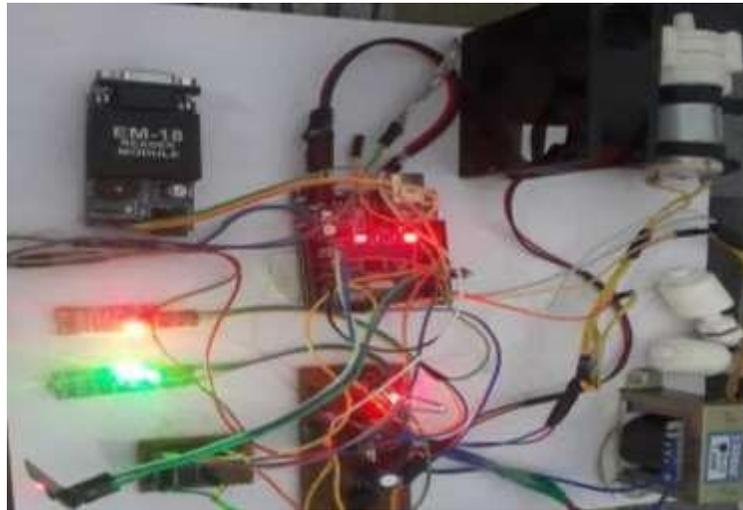

Fig.2: RESULT OF PROJECT

APPLICATIONS

- Educational Institutions
- Corporate Campuses
- Government Offices
- Healthcare Facilities
- Public Libraries
- Event Venues

ADVANTAGES

- Efficient resource management
- Reduced manual labor

- Improved security

- Increased energy efficiency

- Improved attendance tracking

- Enhanced learning and working environment

- Reduced operating costs

- Real-time monitoring of campus resources

- Improved decision-making based on data analysis

- Scalable and adaptable to changing campus needs

CONCLUSION

In conclusion, the smart campus project is designed to automate various processes in a campus environment, from attendance tracking to resource management, and help improve efficiency while reducing manual labor. The use of RFID technology for attendance tracking, smart devices for power-saving in classrooms, and water level control for resource management are some of the innovative solutions offered by the project. The system can also be expanded to include other features such as temperature control, security systems, and real-time monitoring of campus resources.

FUTURE SCOPE

One of the key areas that could be further improved is real-time monitoring of energy usage. By integrating energy monitoring sensors across the entire campus, the system could provide insights into where energy is being consumed and identify opportunities for conservation. Additionally, the system could be expanded to integrate with other campus systems, such as security or building management systems, to provide a more comprehensive solution for campus automation. A mobile application could also be developed to provide students and faculty with real-time information on classroom availability, attendance records, and other relevant data. Finally, integrating the system with AI and machine learning technologies could enable predictive maintenance of campus infrastructure, optimize resource usage, and identify patterns in data for informed decision-making.

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