

IoT Data Logger Using Blynk Framework

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Abstract: In the digital information era, the use of the internet in daily activities has become a necessity. With internet-based information technology, the process of acquisition and delivery of information can run automatically. In collecting data from sensors online, a data logger instrument is needed with the application of the Internet of Thing (IoT) concept so the development of an integrated information system can be carried out. In this research, the data logger is used to obtain temperature and humidity data for a room by utilizing the DHT11 sensor, while the IoT implementation is used to monitor sensor data using the mobile-based Blynk application, which is integrated with the Node MCU microprocessor device. From the results of implementation and testing, the concept of data acquisition and data monitoring can work well where temperature and humidity data can be obtained and processed automatically and in real time via the internet network. It is hoped that this data logger can be used in various fields according to the needs of its users.

Keywords: Internet of things, data logger, DHT11, temperature and humidity, blynk

I. INTRODUCTION

The development of technology plays a significant role in this day and age in making many tasks easier, one of which is obtaining data or information. The process of recording data manually is inefficient and time-consuming, but through technology, many sophisticated devices have been developed that facilitate the data collection process (data logging) such as the data logger device (data recorder).

A data logger is a device used to record and collect data automatically at any time, where the data can come from sensors or electronic instruments and is then used in data analysis [1]. The data can later be processed and applied for many purposes such as weather monitoring [2], temperature and humidity monitoring [3], and industrial needs [4]. Electronic data logger instruments generally consist of a microcontroller and sensors for temperature, air pressure, humidity, altitude, and depth. In addition, there are electronic instruments for data storage.

Some data loggers are integrated with computers or other interface devices with the help of software to activate and visualise data that has been collected from a measured object [5]. With the ability to work without time constraints, it is possible to obtain valid, complete, and comprehensive data that can be accessed in real time.

In this study, the data logger concept will be implemented for measuring temperature and humidity utilising Internet-of-Thing technology so that sensors and other supporting devices can communicate with each other via the internet and send data automatically.

II. METHODOLOGY

2.1. Data storage in the data logger

In general, the working concept of the data logger system begins at data acquisition from the object, which is carried out by a sensor or module; then the data, consisting of time data and sensor values in analogue form, is input to the microprocessor [6]. After converting analogue signal data into digital signal data and configuring it, the data are stored internally where they are available for data analysis; data can also be sent to a cloud storage server via an internet connection. On the input side, there is a power supply that is also connected to the data logger device. The data logger system concept diagram can be seen in Figure 1.

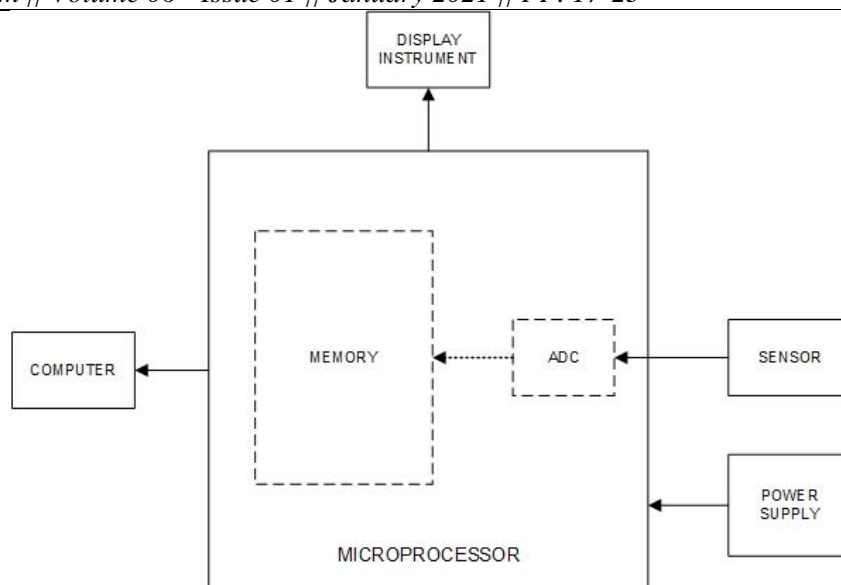


Figure 1. Data Logger System Concept

2.2. Data logger in the Internet-of-Thing (IoT) concept

The developmental trend of information technology in the future will allow various devices to be connected, integrated, and controlled via the internet; this is known as Internet-of-Thing (IoT) [7]. IoT technology provides capabilities such as data sharing, remote control, and so on, including elements that are connected to local and global networks through embedded and always active sensors. In order to maintain the connection, IoT cannot be separated from the devices that support the system [8].

One of the main components of IoT consists of electronic sensors that can send information automatically. This feature can be applied to data acquisition in various fields using data acquisition instruments or data loggers.

The fundamental difference in data acquisition via data loggers utilising Internet-of-Thing technology lies in the storage media. The main components of IoT technology consist of the following:

1. An electronic device equipped with a Wi-Fi module,
2. Internet connection devices such as modems and routers, and
3. Cloud database for data storage.

The data logger process in IoT begins with the sensor—which is connected to a microprocessor equipped with a Wi-Fi module such as NodeMCU—collecting data on the object being measured. Input to the microprocessor is in the form of analogue data values which will be processed to produce digital values and sent to the IoT platform server via an internet connection. The data is stored on the IoT platform cloud server and can be accessed by mobile devices or computers that are also connected to the internet with the help of an application that facilitates reading and visualisation of sensor data.

2.3. NodeMCU

Basically, NodeMCU is a development board based on the ESP8266 module, especially the ESP-12 series. Because there is hardware in the form of an ESP8266 chip packaged with the ability to access Wi-Fi, NodeMCU is suitable for use in IoT-based projects. It also has a USB serial communication feature that is easy to program because it only requires an additional USB data cable. NodeMCU has been developed in several variants by manufacturers including Amica, DOIT, and Lolin/WeMos [9].



Figure 2. NodeMCU ESP8266

2.4. DHT11

There are many sensors that can be used as input to the data logger according to the needs of the researcher. In this study, a DHT11 temperature sensor was used to simulate the data retrieval and storage process. The DHT11 sensor can measure two environmental parameters at once: temperature and humidity; output is in the form of a calibrated digital signal. In this sensor, there is an NTC (negative temperature coefficient) thermistor to measure temperature, a resistive-type humidity sensor, and an eight-bit microcontroller that processes the two sensors and sends the results to the output pin in bi-directional single-wire format (two-way single cable). The temperature measurement range is 0–50 degrees Celsius, and the humidity measurement range is 20–90 percent. The DHT11 sensor requires a power supply of 3–5.5 volts DC.

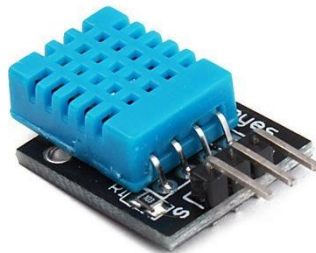


Figure 3. DHT11 Module

2.5. Blynk platform

Blynk is a mobile application for iOS and Android OS that can be used to control devices such as Arduino, Raspberry Pi, and ESP8266, as well as to display sensor data, store data, and visualise data via the internet [10]. The design of Blynk consists of three stages: 1) Create New Project creates a new project and determines the type of device to be controlled; 2) Auth Token sends Blynk token authentication to the user's email to be applied to program code; and 3) Widget box determines the user interface of the Blynk application as a sensor data monitoring interface.

III. DESIGN AND IMPLEMENTATION

There will be three stages in the research: hardware design, firmware design, and software design. Hardware design includes system block diagram design and the selection of components to be used, namely, NodeMCU ESP8266, DHT11 sensor, router, and mobile phone. In designing the firmware, programming will be carried out on the NodeMCU device so that it can function according to the needs of the data logger via the sensor used. Firmware programming will employ the Arduino IDE using the C programming language. Software design will include programming activities using the Blynk framework to acquire and visualise data on Android-based mobile devices.

3.1. Hardware and firmware design

NodeMCU as a controller device will process data from the DHT11 temperature sensor. The data received are temperature and humidity. To access temperature and humidity data from the sensor, the DATA pin on the DHT11 sensor is connected to digital pin D0 on the NodeMCU. The VCC and GND pins on DHT11 are connected with 3V and GND voltages, respectively. In programming, the DHT.h library is used for the communication process between DHT11 and NodeMCU.

For the data communication process between NodeMCU and Blynk, the BlynkSimpleEsp8266.h library and virtual pin function are used to display the data that has been received.

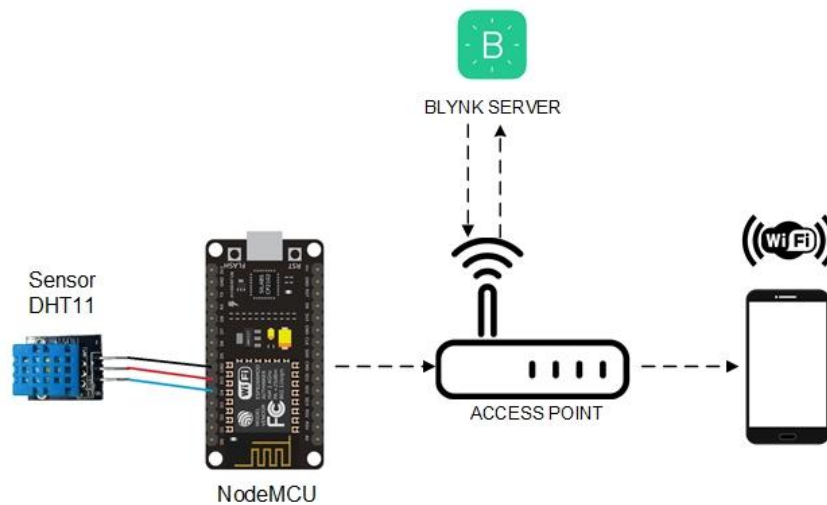
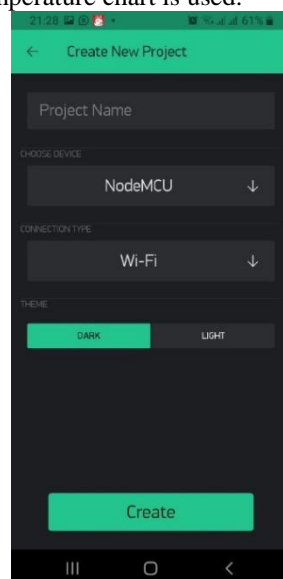


Figure 4. System Block Diagram

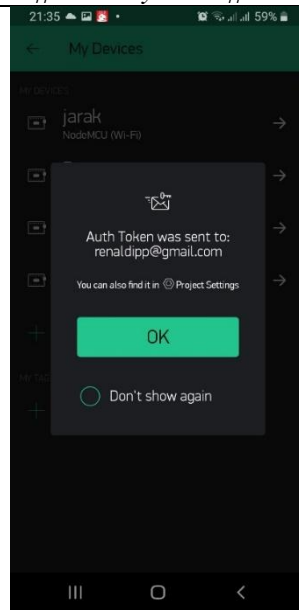
Figure 4 shows that the data input is obtained from the DHT11 sensor, which can detect temperature and humidity by observing changes in room conditions. The signal from the DHT11 sensor is in the form of a number writing system with symbols 0 and 1, namely, the binary number system, and it is processed by NodeMCU so that the binary numbers are converted into decimal numbers. The value of sensor readings is displayed through the Blynk user interface, where in this research, monitoring of room temperature and humidity was carried out.

3.2. Software design

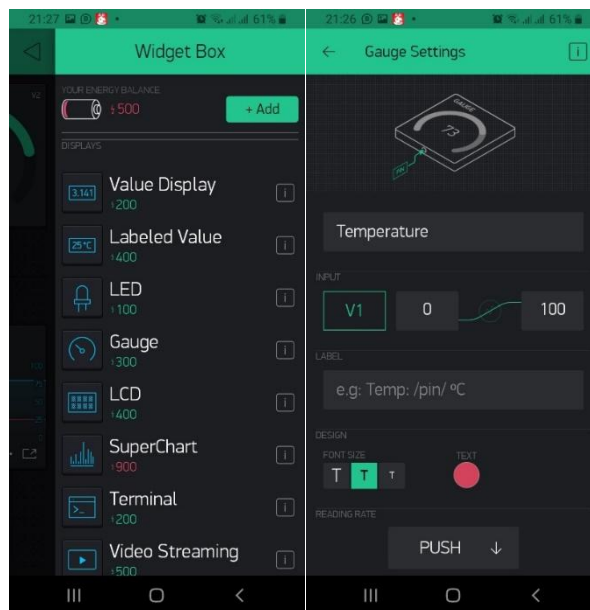
When data acquisition by NodeMCU occurs, the data is configured and sent to the Blynk application server. To read the data, the NodeMCU device must be connected to the Blynk application via the internet. In displaying the data, temperature and humidity will be entered as input via a predetermined virtual pin by adding an interface in the form of a widget-like graphic or in numeric form according to the desired visual appearance. The design using Blynk consists of three stages: 1) Create New Project to create a new project and determine the type of device to be controlled (in this research, the type of device used is NodeMCU); 2) Auth Token to send Blynk token authentication to email to be applied to program code; and 3) Widget is used to determine the user interface display of the Blynk application as a sensor data monitoring interface. In this research, a visual display in the form of a temperature gauge and temperature chart is used.



(a) Creating a New Project



(b) Token Authentication



(c) Widget area to define the appearance of the interface
Figure 5. Blynk Application Design

IV. RESULTS AND DISCUSSION

4.1. DHT11 sensor testing

Table 1. DHT11 Sensor Test

Time	Temperature Values	Humidity Values
18:45	26.1	80
18:44	27	80
18:43	27	80
18:42	27	80
18:41	28	79
18:40	29	79
18:39	29	79
18:38	28.3	79
18:37	28.3	77
18:36	28.3	77

Based on the test results taking the last 10 temperature and humidity readings, it is found that the relative temperature value decreases with time, while the humidity value continues to increase with time.

4.2. Blynk testing

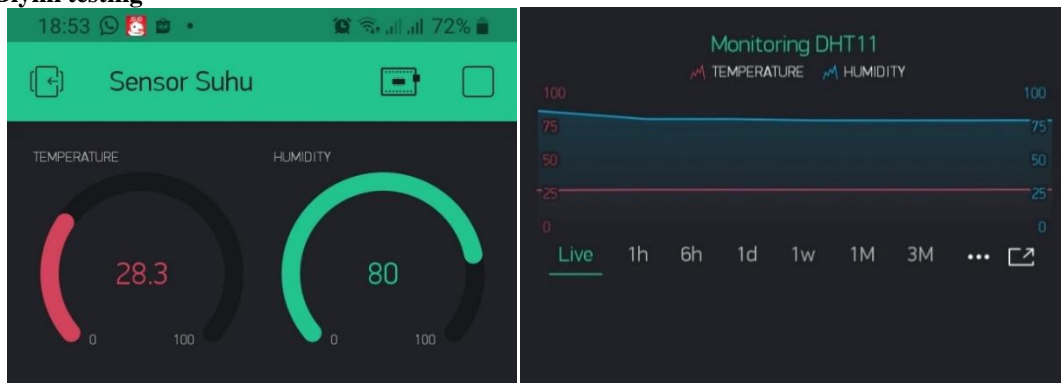


Figure 6. Testing the Blynk Application

Figure 6 shows the data from the implementation of sensors on the Blynk application device with two types of visual displays: gauge and chart. By utilising the Blynk application, temperature and humidity sensor data from a room can be stored and monitored remotely in real time using a mobile device and without being limited by time

V. CONCLUSION

1. Data logger implementation with the Internet-of-Thing concept can be done with lower cost by utilising Node MCU devices and other supporting components such as DHT11 sensors, routers, mobile devices, and the Blynk application.
2. Realtime data logger testing shows good performance in which the DHT11 sensor can be read and the data stored in the Blynk cloud database where it can be accessed and displayed via the Blynk application on the Android OS.

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