Design and Implementation of Intelligent Window based on Embedded System

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Abstract—**With the advance of science associate degreed technology, individuals have a want for convenient and cozy living. Making comfortable and healthy indoor environments may be a major thought for coming up with sensible homes. As hand-held devices become more and more powerful and ubiquitous, this paper proposes an innovative use of smart handheld devices (SHD), exploitation Massachusetts Institute of Technology App creator and fuzzy management, to perform the time period observance and smart control of the designed intelligent window system (IWS) in a smart home. A compact meteorological observation post that consists of setting sensors was created within the IWS for indoor luminance, temperature-humidity, dioxide (CO2) concentration and outside rain and wind direction. Per the measured environment information, the planned system will mechanically send a command to a fuzzy microcontroller performed by Arduino UNO to totally or partially open the electrical curtain and electric window for adapting to climate changes in the indoor and outdoor environment. Moreover, the IWS can automatically shut windows for rain splashing on the window. The conferred novel management methodology for the sill not solely expands the SHD applications, however greatly enhances convenience to users. To validate the feasibleness and effectiveness of the IWS, a laboratory paradigm was designed and confirmed experimentally. AN intelligent window supported the embedded system is introduced during this paper, the system of which may mechanically shut or open the window per the alteration of wetness and wind speed. In addition, network communication and network management operates may be realized during this intelligent system. We tend to establish a fuzzy logical thinking modeling with 2 inputs of temperature and wind speed. The network communication function extraordinarily expedited our remote monitoring. Moreover, we use the Hall sensing element for indicating the various positions of the window. Typically we use the fuzzy inference control and network control to comprehend the motor vehicle and remote moving of the window.**

Keywords—**Nodemcu, Wind Sensor, Rain Sensor, DHT11.**

I. INTRODUCTION

The development of technology allows individuals to form an additional comfortable, more convenient, and far acquirer living space. Because the main location for people's life and work, our buildings need higher and better intelligence. It may be a technical hotspot of the event of design field, its look and development is established on the muse of laptop technology, management technology, and network communication technology so on [1]. Arduino finds applications in various fields of automation [2-5]. Associate degree intelligent window supported the Arduino is intended during this paper. It will decide whether or not it's descending or not in step with the knowledge got by the wetness sensor, therefore assure the window is closed once the rain comes. Moreover, the system of the window can manage the window's gap scale according to the temperature and wind speed.

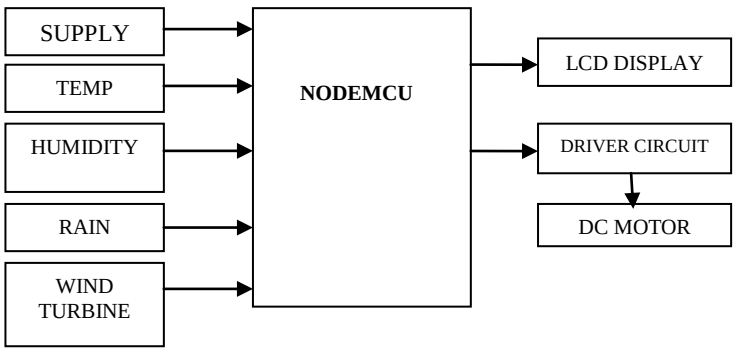

Fig. 1. Block Diagram

In addition, the control system of this window has to operate images assortment and network communication, and it can acquire and store the pictures within the house, therefore, folks can scrutiny the video image transmitted by the network that allows them acquire the information inside the housecat any moment and any place. The indoor climate can avoid offensive from wind and rain by exploitation intelligent window, the intelligent window can also regulate the climate of area mechanically and monitor the indoor circumstance by distance type, that the snug degree, security degree and convenience degree of building all are advanced. Intelligent

window is the vital part of fashionable intelligent building; it is also the important part of the network house.

II. HARDWARE IMPLEMENTATION

A. *NODE MCU*

Node MCU is AN ASCII text file code and development kit that plays a significant role in coming up with your own IOT product employing a few Lau script lines. Multiple GPIO pins on the board permit you to attach the board with different peripherals and are capable of generating PWM, I2C, SPI, and UART serial communications. The interface of the module is especially divided into 2 elements together with each code and Hardware wherever former runs on the ESP8266 Wi-Fi thus and later is predicated on the ESP-12 module. The code relies on Lau – A scripting language that's easy to learn, giving an easy programming surroundings superimposed with a quick scripting language that connects you with a widely known developer community. And open supply firmware provides you the flexibleness to edit modify and restored the present module and keep dynamic the complete interface till you achieve optimizing the module as per your requirements. USB to UART convertor is another on the module that helps in changing USB information to UART data that principally understands the language of serial communication. Rather than the regular USB port, small USB port is enclosed within the module that connects it with the pc for twin purposes: programming Associate in powering up the board. The board incorporates standing semiconductor diode that blinks and turns off immediately, supplying you with the present status of the module if it's running properly once connected with the computer. The flexibility of module to determine a perfect Wi-Fi association between 2 channels makes it an ideal selection for incorporating it with different embedded devices like Raspberry Pi [6-9].

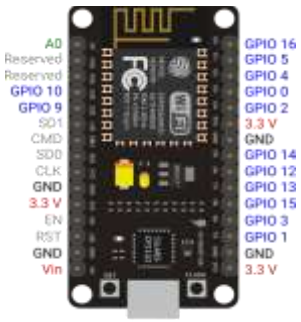

Fig. 2. NODEMCU

B. *Rain sensor*

The rain device module is a simple tool for rain detection. It are often used as a switch once driblet falls through the descending board associated conjointly for measurement precipitation intensity. The module features, a rain board and also the board that's separate for a lot of convenience, power indicator crystal rectifier and an adjustable sensitivity although a potentiometer. The analog output is employed in detection of drops within the quantity of rainfall. Connected to 5V power supply, the LED can activate when induction board has no rain drop, and output is high.

Fig. 3. Rain Sensor

C. *Wind Generator*

Paper deals with the planning and development of a transportable turbine unit, capable of generating electricity from the mechanical energy within the wind. The circuit needs a DC motor, fan blades or propeller, DC-DC boost convertor and wind energy to supply a 5V DC output. Wind-power generation may be a fairly straightforward method that uses a standard miniature DC motor to create a awfully simple wind turbine generator. A miniature DC motor, like RF300FA-12350, is well accessible in the market however can even be taken out from a previous CD/DVD drive/player.

Fig. 4. Wind generator

D. *Motor Driver*

L293D could be a typical Motor driver or Motor Driver IC that permits DC motor to drive on either direction. L293D is a 16-pin IC which might management a group of 2 DC motors at the same time in any direction. It implies that you'll control two DC motor with one L293D IC. The l293d can drive little and quiet huge motors as well, check the Voltage Specification at the tip of this page for additional info. The L293 and L293D devices are quadruple high current 0.5 H-drivers. The L293D is meant to supply metal directional drive currents of up to 1A at voltages from 4.4 to thirty six V. The L293D is designed to provide bi directional drive currents of up to 600-m A at voltages from 4.5V to 36V.Both devices are designed to drive inductive masses akin to relays, solenoids, DC and bipolar stepping motors moreover as different high current/high voltage loads in positive supply applications. Every output could be a complete totem- pole drive circuit, with a Darlington junction transistor sink and a pseudo-Darlington source. Drivers are enabled in pairs with drivers 1 and a pair of enabled by 1,2 linear unit and drivers three and four enabled by 3 and 4

linear unit The L293 and L293D are characterized for operation from 0°C to 70°C.

Fig. 5. L293D Driver Board

E. DHT11 Sensor

Fig. 6. DHT11 Sensor

DHT11 digital temperature and humidness device may be a graduated digital signal output of the temperature and humidity combined sensor. It uses an obsessive digital modules capture technology and also the temperature and humidity sensor technology to confirm that product with high dependableness and glorious long-run stability. device includes a resistive element and a way of wet NTC temperature measure devices and with a superior 8-bit microcontroller connected, output calibrated digital signal. It utilizes exclusive digital-signal-collecting-technique and humidity sensing technology, reassuring its reliability and stability. Its sensing components are connected with 8-bit single-chip computer. each sensing element of this model is temperature remunerated and mark in correct standardization chamber and therefore the calibration-coefficient is saved in OTP memory. tiny size & low consumption & long transmission distance (20m) change DHT11 to be suited altogether forms of harsh application occasions. Single-row packaged with four pins, creating the affiliation very convenient.

III. CIRCUIT DESIGN AND IMPLEMENTATION

This paper involves hardware, code associate degreed code to develop an intelligent system of automatic window motor with various wireless sensing element network (WSN) devices for health and environmental monitoring. The components of this invention are improved by implementing the WSN come in environmental sensors which will notice temperature, humility, harmful gas, smogginess or aerosol, etcetera With embedded system design, these sensors are capable of delivering WSN signal packets supported protocol that follows the IEEE802.14.4 Standards. The primary hardware of the system is that the window motor with circuit style by desegregation small control unit like MCU, RF and WSN antenna to receive command. The code developed below embedded system will bridge hardware and package to manage the window at the desired position. At the rear end, the system software can manage various detector information and supply the interface for remote observance during this analysis work, an Automatic door System victimization an infrared sensor was developed. It uses a sensor, a bearing unit & drive unit to open and shut doors at the doorway of a public building. if there' a disabled person within the house then he/she won't be able to operate the system and this sort of system desires data relating to the operation. The existing merchandise are to be operated manually, and if enclose there' nobody within the home to work the switch then the garments simply get wet and also the product are of no use the aim of this project is to style a window that may close mechanically once it rains or snows. The aim for the manufacture of this product is to avoid all the trouble caused in ceaselessly descending areas by closing the windows automatically. Mechanically close the window when raindrops. Mechanically close the window after detecting a big call air quality (PM10) below a preset level the entire system is comprised of 3 main modules that are window on off management module, pictures assortment module, and web transmission module. The kernel method unit of the system is comprised.

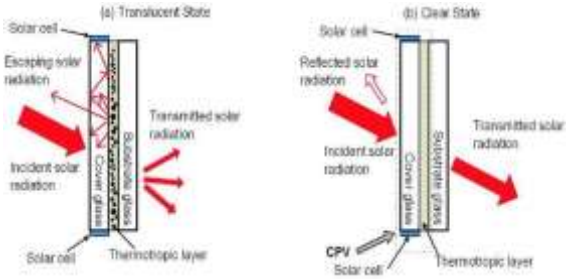

Fig. 7. Working principle of window Closing/ Opening

ARM method or FPGA. ARM technology is that the thought of the embedded system. At present, the ARM chips within the market will even reach a speed of many trillion, and also the systems use these chips as their main controller can build up a system of information collection, data process and communication with high speed and high precise. The system during this paper adopted the processor S3C2410 of the Samsung Company, combined with the µC UNIX system operate system to appreciate the designed function. S3C2410 could be a variety of low price, low power loss, and high behavior microchip of 16/32 bits, that performs quite well within the application field of embedded system. Whereas working, the system can first estimate. Whether it's descending outside supported the knowledge got from the humidness sensor, and therefore the window are closed now once it is raining; otherwise, the system can estimate the gap extent of window based on the results of fuzzy illation per the inputs of wind speed and temperature. Therefore, the part of estimating the opening extent of the window could be a key purpose of the on-off management module. After initial to electrical system initialization, initialization, together with initialization, serial interface clock configuration and time delay perform program initialization and Wi-Fi initialization, timer is initialized, then reads the last window state, buzzer sirens, digital tube and diode lights flashing, Windows mechanically shut the window place, air quality sensing element to gather data, sent to the center to analysis, and build a reply, at a similar time can verify the management instruction, through Wi-Fi to transfer data to

the server. Among them, the information upload and switch window operations love process, adopts double chip control design, a chip is principally used to receive Wi-Fi sensing element information and skim data, another drive motor drive and show circuit and a buzzer limit switch, we tend to prescribed as follows: the primary quite main chips, the second false from the chip. The progress and system initialization of the most chip. once the system is high-powered on, the knowledge set last time is read first, so the buzzer is sounded, that is for the prompt that the circuit runs normally; Then the digital tube flashes many times, indicating that the system is being initialized, and also the window door is mechanically reset, so as to avoid the position of the window caused by the last fault or abnormal power failure. The sensing element unit runs the take a look at program to examine whether or not the sensor is functioning.

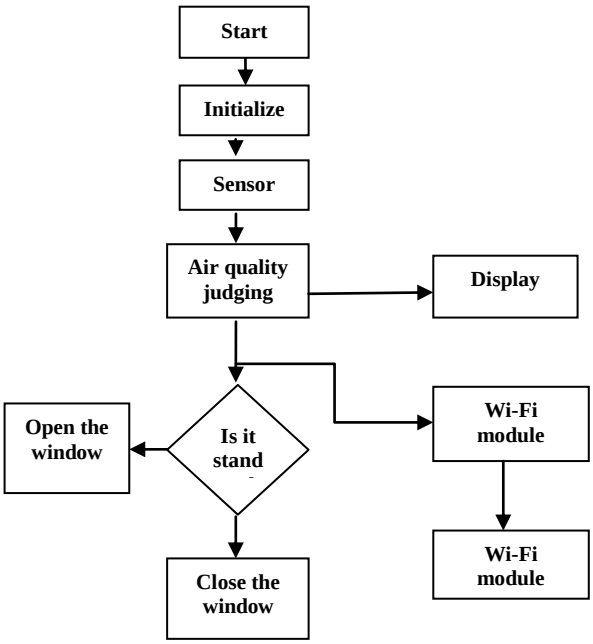

Fig. 8. Flow chart

IV. RESULTS

It can decide whether or not it's descending or not in line with the data got by the wetness sensor, so assure the window is closed once the rain comes. Moreover, the system of the window can management the window's gap scale according to the temperature and wind speed. Therefore, individuals can look over the video image transmitted by the network that allows them acquire the information within the house at any moment and any place. The indoor climate can avoid assaultive from wind and rain by victimization intelligent window, the intelligent window can also regulate the climate of area mechanically and monitor the indoor circumstance by distance type, therefore the snug degree, security degree and convenience degree of building all are advanced. Associate degree intelligent window system supported the embedded system. We have a tendency to adopt a high price/performance magnitude relation Arduino Atmega328p because the main management that in the main accomplished the 2 operates of motorcar-controlling and network monitoring [10-12]. By victimization the auto dominant function, the system will infer the suitable gap extent of the window using sensing element inference, so control the door-motor to drive the window moving to the aimed position. The network transmission function of the system very expedited long-distance monitor, by that we are able to look over the video image transmitted by the network which allows them acquire the data within the house at any moment and any place. Viewing from the angel of intelligent building, this method can shield our house from drench and wind, moreover as keeping the house ventilated.

Fig. 9. Final model of the Project

Besides, its motor car operates of deed pictures and network transmission facilitates US to induce information of the house, so ensured the protection of our house. during a word, this intelligent window expeditiously increased the comfort extent, security extent, and convenience extent of building. From the below figures shown that the LCD Output

Display of Rain sensor working that which as R indicate Rain sensor WG indicate wind generator T is temperature and H indicate the Humidity sensor if R is 0 it known closing the window, R is 1 it known opening the window for rain sensor and Humidity sensor.

Fig. 10. Working of the Project

Fig. 11. Rainsensor opening/closing window

Fig. 12. Wind generator opening/closing window

V. CONCLUSION

This paper introduces an intelligent window system supported the embedded system. We tend to adopt a high price/performance magnitude relation Arduino Atmega328p because the main management that principally realized the 2 operates of auto-controlling and network monitoring. By exploitation the auto-controlling function, the system can infer the acceptable gap extent of the window using detector inference, and then control the door-motor to drive the window moving to the aimed position. The network transmission function of the system extraordinarily expedited long- distance monitor, by which we will look over the video image transmitted by the network which permits them acquire the data inside the house at any moment and any place. Viewing from the angel of intelligent building, this technique will shield our house from drench and wind, moreover as keeping the house ventilated. Besides, its automobile operate of getting pictures and network transmission facilitates America to induce data of the house, therefore ensured the safety of our house. In a very word, this intelligent window with efficiency increased the comfort extent, security extent, and convenience extent of building. Wiper motor is mechanically ON throughout the time of precipitation. The Senor is fastened within the vehicle glass. The conductive (Touch) device is employed during this project. It senses the rainfall and giving management signal to the control unit. The control unit activates the electric motor automatically. This operation is named Rain detection with automatic closing of window. This project will be extended victimization high potency GSM module. The GSM module provides the intimation of the person with this technique through SMS.

REFERENCES

[1] M. Suresh, P. Saravana Kumar and T. V. P. Sundararajan, "IoT Based Airport Parking System," 2015 International Conference on Innovations in Information, Embedded and Communication Systems (ICIIECS), 2015, pp. 1-5, doi: 10.1109/ICIIECS.2015.7193216.

[2] Koteswaramma, N., & Vardhini, P. H. (2019). Implementation of Arduino based Object Detection System. International Journal of Modern Electronics and Communication Engineering (IJMECE), 7(3), 2018-211.

[3] Vardhini, P. H., Ravinder, M., Reddy, P. S., & Supraja, M. (2019). Power Optimized Arduino Baggage Tracking System with Finger Print Authentication. Journal of Applied Science and Computations J-ASC, 6(4), 3655-3660.

[4] K. M. C. Babu and P. A. Harsha Vardhini, "Design and Development of Cost Effective Arduino based Object Sorting System," 2020 International Conference on Smart Electronics and Communication (ICOSEC), 2020, pp. 913-918, doi: 10.1109/ICOSEC49089.2020.9215269.

[5] Babu, K. M. C., Vardhini, P. H., & Koteswaramma, N. (2019). Design and Implementation of Arduino based Riders Safe Guard 2.0. International Journal of Innovative Technology and Exploring Engineering (IJITEE), 9(1), 3078-3083.

[6] P. A. Harsha Vardhini and G. Janardhana Raju, "Design of Internet of Things Based Smart and Efficient Water Distribution System for Urban and Agriculture Areas", Journal of Computational and Theoretical Nanoscience, vol. 17, no. 9–10, pp. 4688-4691, September/October 2020.

[7] Vardhini, PA Harsha, et al. "IoT based wireless data printing using raspberry pi." Journal of Advanced Research in Dynamical and Control Systems 11.4 (2019): 2141-2145.

[8] D. V et al., "Raspberry Pi Based Automated and Efficient Irrigation System With Add-On Field Security", IJAST, vol. 28, no. 19, pp. 192-196, Dec. 2019.

[9] Vardhini, PA Harsha, N. Koteswaramma, and K. Murali Chandra Babu. "IoT based raspberry pi crop vandalism prevention system." International Journal of Innovative Technology and Exploring Engineering 9.1 (2019): 3188-3192.

[10] N. Ananthula and P. A. H. Vardhini, "Design and Implementation of Internet of Things based Spybot," 2021 IEEE International Conference on Intelligent Systems, Smart and Green Technologies (ICISSGT), 2021, pp. 63-67, doi: 10.1109/ICISSGT52025.2021.00024.

[11] K. S. S. Javvaji, U. R. Nelakuditi and B. P. Dadi, "IoT Based Cost Effective Home Automation and Security System," 2020 11th International Conference on Computing, Communication and Networking Technologies (ICCCNT), 2020, pp. 1-5, doi: 10.1109/ICCCNT49239.2020.9225557.

[12] Shivaprasad Satla, Suresh Babu Satukumati, I Navakanth, "Road Accident Prediction System for Highway Authorities", pp. 10133 – 10142, Vol.29, Issue 3, International Journal of Advanced Science and Technology, 2020.

[13] P. A. Harsha Vardhini, M. S. Harsha, P. N. Sai and P. Srikanth, "IoT based Smart Medicine Assistive System for Memory Impairment Patient," 2020 12th International Conference on Computational Intelligence and Communication Networks (CICN), 2020, pp. 182-186, doi: 10.1109/CICN49253.2020.9242562.