SMART MILITARY BASE

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***Abstract*—**In the present time internet becomes an essential need and without it we can't imagine our lifestyle. This paper talks about a smart military base which is design to upgrade the defence security of our military. It collects data from various sensors fitted inside it and send it to the cloud storage having IP address 184.106.153.149 . We use ESP8266 WIFI module for uploading the data on the cloud in real time and Arduino uno microcontroller board to control all the sensors and modules. We can observe the movement ,temperature, flammable or toxic gases present in the air and humidity inside the base from any corner of the world. This project is based on the concept of internet of things(IoT).

***Index Terms*—Smart, IoT, Sensors, Data, Graph, ESP8266, Arduino uno, ThingSpeak.**

I. INTRODUCTION

With the invention of distructive weapons globally in today's world it is necessary to upgrade our defence security systems for the military, so in this field we presents our smart military base which provides high level security with the use of latest technology. In our model there are basically three rooms: armoury ,interrogation room and a control room from where we can monitor the smart base. The smart base is equipped with some latest technology sensors which collects the data and display it on a server in real time. There is a control room for continuous monitoring of base having smart door lock with RFID (rc522) reader module with a servo motor gate which provides access to the selected officials only. The room is also equipped with a manual siren switch so the staff can use it in case of any emergency. The PIR motion sensor is used to detect unnecessary movement inside the armoury and it activates the security systems when motion is captured. The interrogation room contains an IR sensor that activates whenever someone tries to escape from the room. We use a DHT-11 sensor for monitoring temperature and humidity inside the base and MQ-2 gas sensor for determining the concentration of flammable gases if present inside the base. We use ESP8266 wifi module for uploading the data to ThingSpeak channel which is an open IoT platform. The data is posted in every two minutes and the web page updated automatically with new readings. There are four graphs in the web page representing gas data, temperature, humidity and the motion captured for interrogation room. We use 5v dc power source to power the arduino. The on duty staff can also analyse the past data for any investigation. For controlling all the sensors and modules we use Arduino microcontroller and programming is done with Arduino ide software. So with the use of IoT and modern sensors normal military bases can be upgraded.

II. INTERNET OF THINGS (IOT)

The internet of things(IoT) describes the network of physical objects that are embedded with sensors, software and other technologies for the purpose of connecting and exchanging data with other devices over the internet [1]. In recent years this technology has experienced tremendous growth, and is projected to expand more rapidly in the future. IoT devices contain sensors and mini-computer processors that act on the data collected by the sensors via machine learning. This data can help the machine learn your preferences and adjust itself accordingly. Such a rapid expansion of IoT is enabled by some key technologies, such as high speed wireless networks, fast growing cloud services and low cost wireless devices [2]. We use ThingSpeak which is an IoT analytics platform service that let's you to view and analyse live data in the cloud and also give you the ability to execute Matlab code [3]. The wifi

Fig. 1. ESP8266 Serial WIFI Wireless Transceiver Module

module we used in the project is ESP8266 wifi module. It is derived from the family of ESP32 boards and it contains a wifi microchip with full TCP/IP stack and microcontroller capability with built in power and flash led that indicates it's working [4].

III. PROPOSED SYSTEM WITH HARDWARE DESCRIPTION

We use different types of sensors to collect data in real time from the smart base and upload it to the cloud storage [5].

The sensed data is sent through internet to a remote cloud

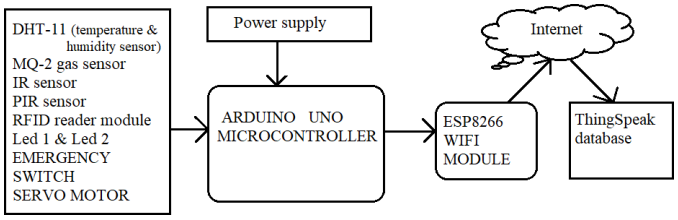

Fig. 2. Proposed system block diagram

Storage open IoT API ThingSpeak [6]. Some sensors works on 5 volts dc and some on 3.3 volts dc supplied by Arduino board, ground pin in Arduino is common to all. Apart from the hardware described below a passive buzzer, jumper wires, some led's and a breadboard is used.

A. Arduino UNO

Arduino is an open source electronic prototyping platform based on ATmega328p microcontroller. It comes with fourteen digital input/output pins and six analog inputs, we can connect it to the computer via a USB cable [7]. We use it in our smart base to control all the sensors and WIFI module.

B. ESP8266 WIFI module

It is a self-contained SOC with integrated TCP/IP protocol stack that can give any microcontroller access to your WIFI network. The WIFI serial module works in both directions: it uses TX/RX serial link to send and recieve data (figure 1).

C. RC-522 RFID Reader Module

Radio-frequency identification (RFID) uses electromagnetic fields to automatically identify the tags attached to objects when triggered by an electromagnetic interrogation pulse from a nearby RFID reader device. They have a short distance range of 0 to 10mm. RFID tag is predefined by a unique ID number that can be read by the RFID reader [8]. We use RC-522 in the control room entrance to enhance the security of the smart base. If the official got the access then only the door will open which is mechanically connected to servo motor.

D. PIR motion sensor

Passive infrared sensor is low powered motion detector which has wide angle and long range motion detection. It comes with two inbuilt potentiometers for adjusting time delay and sensitivity [9]. It has three pins ground, vcc and output. We fix this in the armoury so if it detects any movement inside the room in the same time the indicator led goes on which is in the control room and alerts the security system.

E. DHT-11 sensor

The DHT-11 is a basic digital temperature and humidity sensor which uses a capacitive humidity sensor and a thermistor to measure the surrounding air, and spits out a digital signal on the data pin [10]. We fix it inside the base so it can read the atmosphere inside the base and gives temperature values in degree celcius and humidity values in percentage.

F. MQ-2 gas sensor

In MQ sensor series MQ-2 is a gas sensor which can detect LPG, smoke, alcohol, propane, hydrogen etc. present in air [11]. In our project we use it to determine the air quality inside the base. The real time readings can be seen on the cloud storage.

G. IR sensor

IR sensor is an electronic device, that emits the light in order to sense some object of the surroundings. An IR sensor can measure the heat of an object as well as detects the motion. Usually, in the infrared spectrum, all the objects radiate some form of thermal radiation. It has three pins vcc, gnd and the output pin. It comes with an inbuilt potentiometer which is used to set it's range [12]. We fix an IR sensor on the passage of the interrogation room so if the intruder tries to escape from the room the security systems activates.

IV. IMPLEMENTATION WITH RESULTS

To collect the data we left the smart base working for different time intervals so that it captures the readings correctly with variations in it. The base sends fifty readings to the cloud storage platform in different time spans [13]. Starting with RFID reader module if we want to get in the control room we need to put the RFID tag on reader module and if access is granted the door will open which is mechanically connected with servo motor otherwise "access denied" this message will be displayed on the serial monitor screen. There is a manual

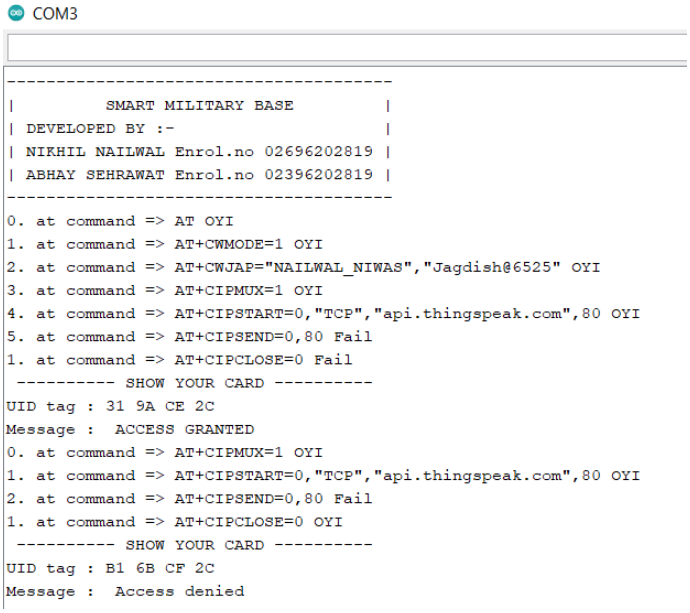

Fig. 3. Arduino IDE serial monitor

siren switch of passive buzzer inside the control room so the staff can alert the base in case of any emergency. PIR motion sensor is used in the armoury so if it detects any movement inside the room in the same time the indicator led goes on which is in the control room and alerts the security system.

DHT-11 temperature and humidity sensor is used which gives the readings according to the inside conditions of the base [14]. The collected temperature values is displayed on the thingspeak channel by the means of a graph. In the graph time

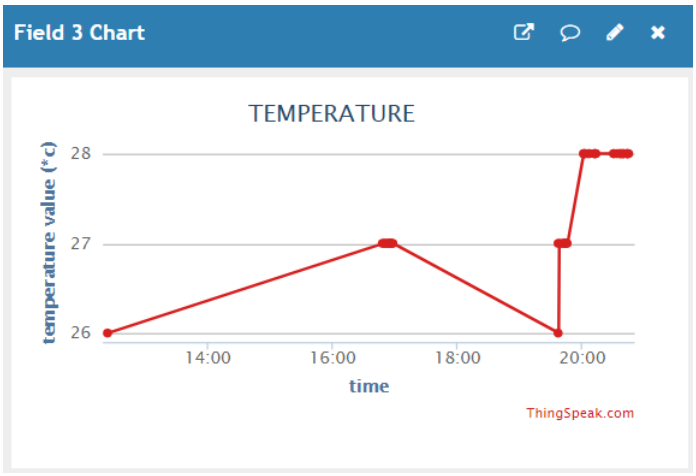

Fig. 4. Temperature variation graph

is on the x axis and the measured value is on y axis. Similarly the humidity graph is given below. MQ-2 gas sensor is used

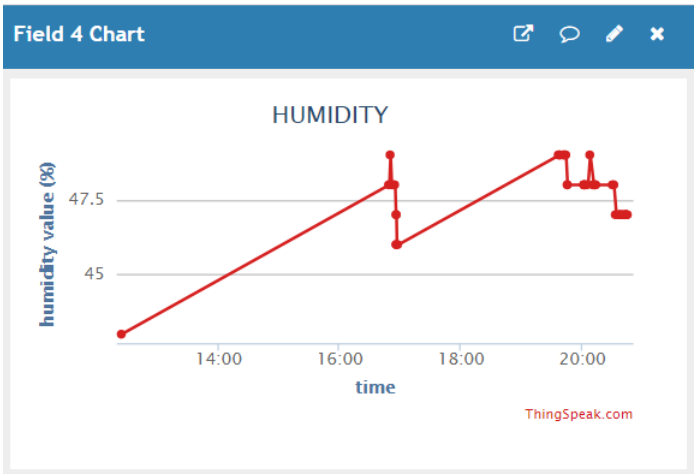

Fig. 5. Humidity variation graph

to monitor the air quality of the base. The high values in the graph represents that some flammable gas is present in the air and the low values represent the normal conditions. IR sensor which is in interrogation room activates when someone tries to escape from the room and at the same time one led goes on in the control room which alerts the security systems [15]. The peak values in the interrogation room graph shows that the intruder is trying to escape from room with the real time displayed on the graph. The officials can read the previous data save on the cloud for investigation purpose.

CONCLUSION

This paper proposed a framework in light of IoT to accomplish smart military base and it is working perfectly to give real

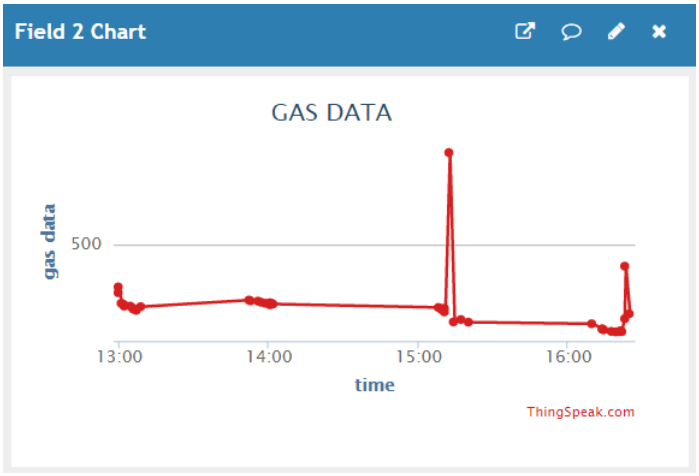

Fig. 6. Gas variation graph

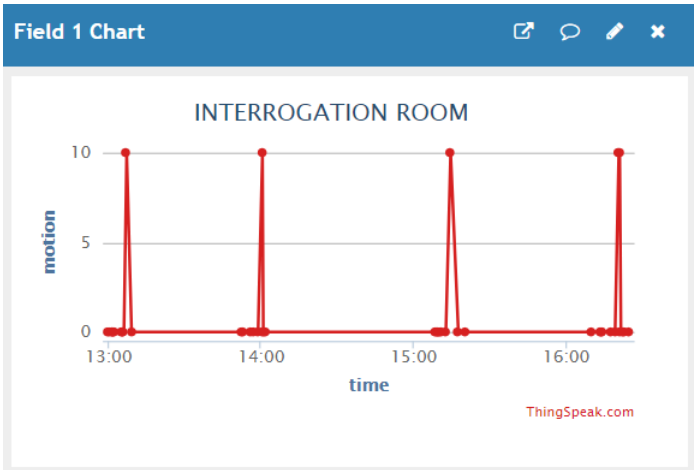

Fig. 7. Interrogation room graph

time readings of temperature, humidity, air quality inside base and the motion detection inside two rooms. All the collected data is uploaded to cloud storage and we can analyse it later as per our need. So in this way we can monitor the smart base in real time and provide high level security. Future work includes interconnection of such smart bases with one main headquarter and also in the direction to enhance it's security.

REFERENCES

[1]P. Yadav and S. Vishwakarma, "Application of Internet of Things and Big Data towards a Smart City," 2018 3rd International Conference On Internet of Things: Smart Innovation and Usages (IoT-SIU), Bhimtal, India, 2018, pp. 1-5, doi: 10.1109/IoT-SIU.2018.8519920.

[2]E. P. Yadav, E. A. Mittal and H. Yadav, "IoT: Challenges and Issues in Indian Perspective," 2018 3rd International Conference On Internet of Things: Smart Innovation and Usages (IoT-SIU), Bhimtal, India, 2018, pp. 1-5, doi: 10.1109/IoT-SIU.2018.8519869.

[3]K. Sabancı, E. Yigit, D. Ü stün, A. Toktaş and Y. Ç elik, "Things- peak Based Monitoring IoT System for Counting People in A Library," 2018 International Conference on Artificial Intelligence and Data Processing (IDAP), Malatya, Turkey, 2018, pp. 1-6, doi: 10.1109/IDAP.2018.8620793.

[4] Yoppy, R. H. Arjadi, H. Candra, H. D. Prananto and T. A. W. Wijanarko, "RSSI Comparison of ESP8266 Modules," 2018 Electrical Power, Electronics, Communications, Controls and Informatics Seminar (EECCIS), Batu, Indonesia, 2018, pp. 150-153, doi: 10.1109/EEC-CIS.2018.8692892.

[5]R. Kanan and H. Arbess, "An IoT-Based Intelligent System for Real-Time Parking Monitoring and Automatic Billing," 2020 IEEE International Conference on Informatics, IoT, and En- abling Technologies (ICIoT), Doha, Qatar, 2020, pp. 622-626, doi: 10.1109/ICIoT48696.2020.9089589.

[6]D. Parida, A. Behera, J. K. Naik, S. Pattanaik and R. S. Nanda, "Real- time Environment Monitoring System using ESP8266 and ThingSpeak on Internet of Things Platform," 2019 International Conference on Intelligent Computing and Control Systems (ICCS), Madurai, India, 2019, pp. 225-229, doi: 10.1109/ICCS45141.2019.9065451.

[7]H. Benyezza, M. Bouhedda, K. Djellout and A. Saidi, "Smart Irrigation System Based Thingspeak and Arduino," 2018 International Conference on Applied Smart Systems (ICASS), Medea, Algeria, 2018, pp. 1-4, doi: 10.1109/ICASS.2018.8651993.

[8]T. M. A. M. Fadzir, H. Mansor, T. S. Gunawan and Z. Janin, "Development of School Bus Security System Based on RFID and GSM Technonologies for Klang Valley Area," 2018 IEEE 5th Inter- national Conference on Smart Instrumentation, Measurement and Ap- plication (ICSIMA), Songkla, Thailand, 2018, pp. 1-5, doi: 10.1109/IC- SIMA.2018.8688783.

[9]S. A. Khan, I. Ahmad, A. Shufian and M. S. Ahmed, "A Smart Intruder Alert System Based on Microprocessor and Motion Detection," 2019 International Conference on Robotics,Electrical and Signal Processing Techniques (ICREST), Dhaka, Bangladesh, 2019, pp. 335-339, doi: 10.1109/ICREST.2019.8644109.

[10]F. Margret Sharmila, P. Suryaganesh, M. Abishek and U. Benny, "Iot Based Smart Window using Sensor Dht11," 2019 5th In- ternational Conference on Advanced Computing Communication Systems (ICACCS), Coimbatore, India, 2019, pp. 782-784, doi: 10.1109/ICACCS.2019.8728426.

[11]I. K. N. Trisnawan, A. N. Jati, N. Istiqomah and I. Wasisto, "Detection of Gas Leaks Using The MQ-2 Gas Sensor on the Autonomous Mobile Sensor," 2019 International Conference on Computer, Control, Informatics and its Applications (IC3INA), Tangerang, Indonesia, 2019, pp. 177-180, doi: 10.1109/IC3INA48034.2019.8949597.

[12]D. Purcaru, I. M. Gordan and A. Purcaru, "Study, testing and application of proximity sensors for experimental training on measurement systems," 2017 18th International Carpathian Control Conference (ICCC), Sinaia, Romania, 2017, pp. 263-266, doi: 10.1109/CarpathianCC.2017.7970408.

[13]A. K. Gupta and R. Johari, "IOT based Electrical Device

Surveillance and Control System," 2019 4th International Conference on Internet of Things: Smart Innovation and Usages (IoT-SIU), Ghaziabad, India, 2019, pp. 1-5, doi: 10.1109/IoT-SIU.2019.8777342.

[14] G. M. Debele and X. Qian, "Automatic Room Temperature Control System Using Arduino UNO R3 and DHT11 Sensor," 2020 17th In- ternational Computer Conference on Wavelet Active Media Technology and Information Processing (ICCWAMTIP), Chengdu, China, 2020, pp. 428-432, doi: 10.1109/ICCWAMTIP51612.2020.9317307.

[15] E. Vitenburg and A. Nikishova, "Project of Automated System's In- formation Security System Selection," 2019 International Science and Technology Conference "EastConf", Vladivostok, Russia, 2019, pp. 1- 5, doi: 10.1109/EastConf.2019.8725345.