# Development of an App Based Industrial Safety Security System

**In partial Fulfillment for the Degree of Bachelor of Science in**


## Mechanical Engineering

## Submitted By


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**Department of Mechanical Engineering**

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# Development of an App Based Industrial Safety Security System

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**Dated Approved: 16-May, 2022**

# DECLARATION

We hereby, declare that the thesis report carried only by us the supervisor of **Saikat Biswas,** Lecturer, of Department of Mechanical Engineering, Sonargaon University. We have tried our best to make the thesis report with accurate information & relevant data.

We hereby ensure that, this thesis has not been submitted to anywhere for the award of any degree.

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# ALL ABBREVIATION & MEANINGS

In this project we have used some shortcut keyword. For that reason all the abbreviation are given below.

1. **IoT Based** – Internet of Things based
2. **PHP** – Personal Home Page
3. **HTML** – Hypertext Markup Language
4. **MySQL**- My Structured Query Language (It is an Open-source relational data based system.
5. **WAMP** – Windows, Apache, MySQL and PHP (It is a variation of LAMP for windows)
6. **PC**- Personal Computer.
7. **OBD**- On-Board Diagnosis port
8. **OBD II** – On-Board Diagnosis 2 port
9. **EPA** – Environmental Protection Agency
10. **SAE** – Society of Automotive Engineers
11. **VEDAS** – Valcom Environmental Acquisition System. (It is a mobile data stream mining environment)
12. **Minefleet**- It is also a mobile data stream mining environment.
13. **PCA** – Principle Component Analysis.
14. **SAWUR**–Situation Awareness With Ubiquitous data mining for Road safety.
15. **NodeMCU** – Open source electronics Platform.
16. **LED** – Light Emitting Diode.
17. **PCB** – Printed Circuit Board.
18. **Arduino** – It's a open source electronic Platform.
19. **USB** – Universal Serial Bus.
20. **iOS**- Internetwork Operating System.
21. **Thunkable** – Easiest way to build up apps
22. **APK** – Android Application Package
23. **LCD**- Liquid Crystal Display
24. **GPS** – Global Positioning System
25. **Buzzer** – An electrical device that makes a buzzing noise & used for signaling.
26. **PVC Board** – Polyvinyl Chloride board.

# ABSTRACT

Now a days, safety is considered a top priority due to its significance in safeguarding human lives and properties, especially in high-risk industrial sectors such as aviation, oil and gas, construction, transportation, steel manufacturing, and mining industries. In these industries, different types of injuries, illness and fatalities because of the dangerous work environments. Again in some industries face theft products and parts. It is important to establish and execute an effective safety management system to prevent the risks of irreversible accidents and security system. We present a view on the system security, which draws from the previous experiences in dealing with system safety. This project paper specializes in exploring the commonalities among protection and safety with each dealt with as at the same time complementary view of the identical problem. It follows with an in depth description of present and generally used protection overall performance size techniques. Several case research are used to provide an explanation for the techniques and discover the critical utility regions applicable to maximum commercial sectors. The strategies and equipment for protection statistics collection, analysis, and sharing are delivered collectively with their programs for protection control. Finally, mutual relationships of safety and security are discussed.

# ACKNOWLEDGEMENT

First of all, we would like to express our gratitude to the almighty Allah for providing us with strength and energy to successfully complete our research.

It is obvious that, research is not possible without other people, their guidance, advice, and motivation to understand goals and objective. Our sincere gratitude is to **Saikat Biswas**, Lecturer, Department of Mechanical Engineering, Sonargaon University our supervisor for his helpful guidance, suggestion and encouragement throughout this study. He supported us in any possible aspect with strong dedication, patience and humor. He made our time as a project student enjoyable and fascinating by opening doors to new experiences in our life.

We are very much grateful to **Prof. Dr. Md Alamgir Hossain**, Dean, Faculty of Science & Engineering, Sonargaon University & others faculty members.

# CHAPTER 1

# INTRODUCTION

## 1.1 Introduction

In this busy world everyone connect with different types of industry. Some people directly attach with various types of industry. Especially workers directly connect with machine and machineries. The unsafe work surroundings function of commercial centers is obvious with inside the excessive quotes of workplace accidents and fatalities skilled regularly [1]. These excessive-chance industries consist of construction, metal manufacturing, oil and gas, aviation, agriculture, forestry, fishing, and hunting, etc.

Due to rapid industrialization, industrial workers exposed several types of accidents and illness. Every year lakhs of employees or workers are injured to mechanical, chemical, electrical and radiation and it results in partial or overall disablement. So in current years, more interest is given to fitness protection because of stress from government, exchange unions, hard work legal guidelines and recognition of employers [2]. The performance of workers depends to outstanding on the environment in which the work. Work surroundings includes all of the factors, which act and react at the frame and thoughts of an employee. The primary aim to create an environment, which ensures the greatest ease of work and removes all work and removes all reasons of worries.

Steel production is one of the maximum dangerous industries due to its complicated socio-technical system. The metal production procedure includes using excessive generation and bodily hard work, making protection control a complex task [3]. Members of the U.S. metal production enterprise retain to revel in a vast variety of injuries, illnesses, and fatalities. The mixture of elaborate generation and bodily hard work creates a complicated challenge for safety managers in steel production.

The essential intention of measuring protection overall performance is to create and put into effect intervention techniques for capacity avoidance of destiny accidents. Recognizing indicators earlier than a twist of fate happens gives the capacity for enhancing protection; many businesses have sought to broaden packages to pick out

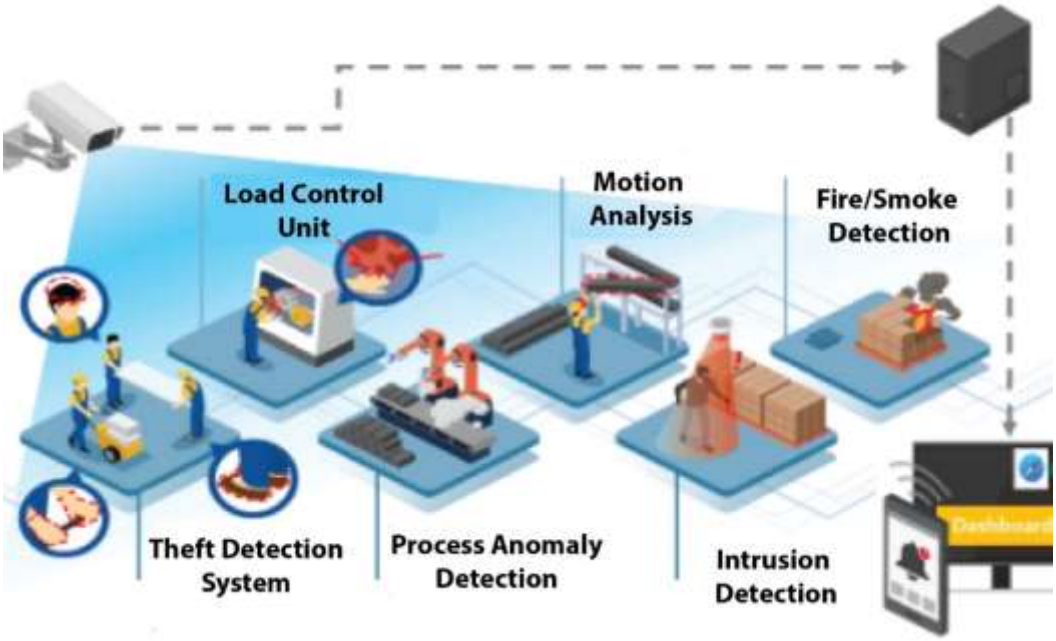



Figure 1.1: Different Types of Control Unit

and advantage from alerts, indicators, and earlier indicators. [4] Traditional measures of protection overall performance depend upon a few shape of twist of fate or harm statistics, with movements being taken in reaction to negative traits in injuries. Many organizations depend closely on failure statistics to screen overall performance. The outcome of this method is that enhancements or adjustments are handiest decided after something has long gone wrong. In maximum cases, the distinction among whether or not a device failure effects in a minor or catastrophic final results is purely a matter of chance [5].

There are some methods to prevent such an industrial accident and the most effective method is to develop the automation base IOT system and real time monitoring during working time, conducting behavioral based study to reduce the accident rates to improve the safe environment in industry. From the various studies, we can clearly say that, one of the causes for initiation of industrial accident is poor management system such as policy, safety systems etc.[3] For improving the safety sensor base monitoring

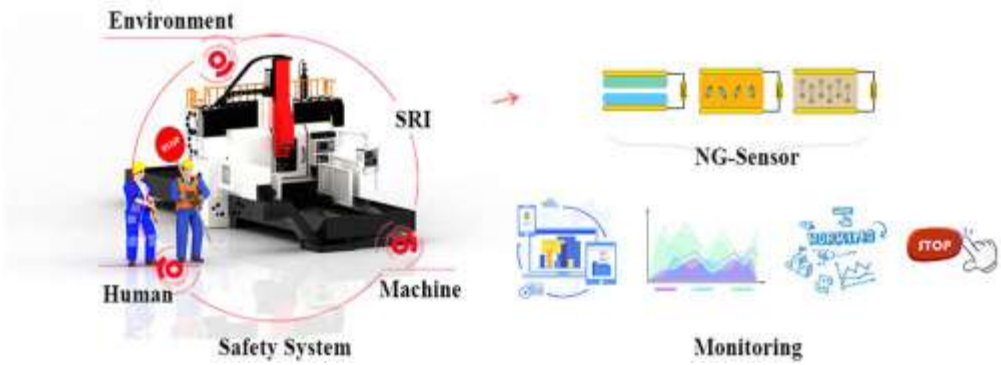



Figure 1.2: Sensor Base Automation System

system should applied in industry. We use different types of sensors as fire sensor, smoke sensor, gas sensor, and motion sensor etc. for this project. For global monitoring system a microcontroller implement here which is collecting data through internet. This system monitor from any place of the world. So that industries authority easily monitor their industries. Using motion sensors, it also gives safety to industry. [6]

Having an effective employees health and safety program should be part of an organization top priority , this is because it ensures less injury and safeguard life , improves workers productivity and the cost of solving and treating injuries resulting from non-implementation of health and safety program. [7] Thus, as suggested by health and safety should focus on employees' involvement, continuous monitoring and wellness component. The essence of this is to make sure workers have safe and good work condition and ensure people are fit to perform their work without much risk to life.

So, the aim of this project is industrial safety and monitoring system develop with the help of IoT.

## 1.2 Objective of the Study

- To design and fabrication system of an automatic safety security.
- To identify the accidents occurred in the industry and get signal from the accidents spot to the authority.
- To comparative study in terms of performance and cost analysis.

## 1.3 Outline of the Thesis:

- Chapter-1 Introduction

  We have developed a system with IoT based industrial safety security. It provides real monitoring system. Different types of sensor and equipment use to build this infrastructure. We used gas sensor of MQ (MQ-2, MQ-5) series. [8] Fire sensor uses to detect presence of fire. We used firebase as a database in our system. All sensor data store in firebase. This project guarantees much less damage and protect life, improves employees productiveness.

- Chapter-2 Literature Review:

  For developing this system, we read some thesis and research paper. It discusses the different ways of Industrial safety security and prevent accidents. From this information, we got different way to develop our project. This type of research paper are useful for improving safety system and provide a peaceful environment in industry.

- Chapter-3 Methodology:

  The methodology is the general research strategy that outlines the way in which research is to be undertaken and among other things, identifies the methods to be used in it. In this chapter, we discussed how to complete our project step by step. For developing this system, we divided our working plan in different portion. Follow this working path, we are finally built our project.

- Chapter-4 Design and Implementation:

  Hardware and combination system are used to build this project. For hardware, we used microcontroller, sensor, pump, motor, pocket router etc. For software section, we develop our coding at Arduino platform. Arduino use C/C++ as programming languages. Power supply has been used to keep the microcontroller running. For monitoring this whole system, we have developed an app by MIT app inventor.

- Chapter-5 Database Management:

  In this chapter database system developed for storing our data in online. For this we are used firebase database. It is cloud monitoring system. All data of sensor are gone here as an integer.

- Chapter-6 Apps Development:

  MIT app inventor is an open platform to develop an app. Block programing system use in this platform. Through this apps, we built a relation between database and microcontroller. This android application helps us to monitor the system.

- Chapter-7 Result and Discussions:

  In this chapter, we discussed about performance of microcontroller. We also discussed legacy of microcontroller and also discussed limitation of our project. Finally, we suggest how to improve this system. We also discussed this project how to benefit our industry.

- Chapter-8 Conclusion:

  Our primary goal was to extend a solution that would allow authority to monitor any place in industry and provide safety to worker using an IoT based infrastructure. It is cost effective project and authority also benefits using this system.

# CHAPTER 2

# LITERATURE REVIEW

Here has some IoT base Industrial safety and Accident Monitoring system developed. Discussion is going to review those papers.

A safety work environment is an environment free of trouble and risk to workers .The concept of industrial safety security system is essential in reinforcing occupational health. However, work place environment is not totally free of risks and danger thus providing an enabling environment that promotes wellbeing of workers is very necessary for employees' performance. This paper discusses in brief the problem of health and safety issues of worker at garment industries in Bangladesh based upon the industry environment, their residential environment, working condition, age, problem of health, causes of diseases, causes of fire accident and their medical facilities. [1]

Fire causes tremendous loss of lives and properties consistently in Bangladesh. Breaking down past flame episodes, realities are uncovered. A few industries has inadequate fire safeguard materials, electric cut off broken electrical wiring, nearness of inflammable materials, infringement of flame security and absence of sufficient mindfulness and so forth [5]. Fire detection system proposed in this paper. From the survey taken most of the fire detection method detects fire after it is triggered. In this paper, we are proposed system the fire safety practices is going to implement for the fire crackers industry. In that the root cause for the fire is to be analyzed and prevent from the fire before it is triggered. Through this hazardous fire accidents can be avoided and many lives can be saved.

Gas detections are vital issues for all spheres of lives where precautions are very important. To ensure safety condition a system has been developed which is

reliable in detecting gas leakage and can even detect the specific room or floor in which the fault is present. Moreover, the system can send an alert message regarding the information of gas leakage to the nearest fire service station [9]. We present a detailed overview on gas leakage localization and tracking problem from the view of precision, robustness, and energy consumption issues. This paper also presents the research directions for existing and future gas leakage and provide safety in our industry.

This system developed for industrial safety management. It follows with an extensive description of existing and commonly used safety performance measurement methods. Several case studies are used to explain the methods and explore the important application areas relevant to most industrial sectors. The techniques and tools for safety data collection, analysis, and sharing are introduced together with their applications for safety management while the use of emerging technologies for enhancing safety management in most industries is discussed in the last section. [2]

In this paper, they present in this article human detection and tracking algorithm using infrared vision in order to have reliable information on a room occupation. They propose an extension of these machine learning algorithms using advantages given by the video. In their approach, the foreground segmentation is used in order to limit the search space of our classifier. [6] But this system is little more expensive. So we proposed a sensor base security system so that we can get feedback easily.

Intrusion detection and prevention is also a key aspect of safety and security. Some researchers have proposed systems with the main objective of keeping theft and unwanted guests away from important locations. These systems are usually deployed using specialized sensors (PIR.), microcontrollers (nodeMCU) and intrusion alert systems which may incorporate alarm systems and the short message service (SMS) using cloud technologies. In some other works, a

combination of intrusion detection and prevention, as well as gas detection systems have been proposed.

This system operated by indicating an increase temperature above the safe limit in the room where it was fixed. In the proposed system, a smoke detector upon senses smoke activates its alarm, sends a low voltage signal to all other smoke detectors in the vicinity. This low voltage signal activates the individual pins of our controller. In this system the transmitter and receiver are installed in a unit and the need for a base is eliminated. [8] The individual smoke detectors are equipped with all the electronics required to both send and receive signals. It also provide security of our system and detect accident before occurring fire. These sensors can be used to detect combustion gases at very low concentration levels.

This system developed which deals with causes of accident and from these causes, we may to find out solutions and it tends to increase the performance of safety culture, safety performance and behavior of the employee. Training, education meeting and communication also plays a major role in accident because the performance of communication from top level to low level management is very poor. [3]

This system specially designed issue of health and safety of employees. It was concluded that employees' low performance can be attributed to both low health and safety practices and lack of personal protecting equipment (PPE) and management commitment to health and safety programs. The four independent measures of industrial health and safety as was used in the study were found to be influencing employee's performance. It was recommended among others that there should be constant health and safety training for both top, middle and low level staff. As this will equip the employees with health and safety culture, as no one is above accident. [4]

We studied each paper very carefully. Then we have developed app based industrial safety security system. The processing sensor analysis of PIR sensor, fire sensor, smoke sensor, gas sensor based sector analysis and identification. Any problem occurring in industries (Fire, gas sensor etc.) and any object identification indicate and sent through the system. The microcontroller use to controlling. A WiFi mod connect with controller. Here all input signal send to firebase. Through this database, whole system will be monitored by an android app. In this system, a submersible pump was placed to provide water so fire extinguishing. And also placed servo motor to open our industries gate.

# CHAPTER 3

# METHODOLOGY

## 3.1 Introduction

Methodology is the systematic, theoretical analysis of the methods applied to a field of study. Actually Methodology is some theoretical step or work schedule that flowed by any project. It helps us to complete our project at right time. Whole project has been divided some section. We have followed step by step. Through methodology, we have collected all possible requirements which are very well documented there are no ambiguous requirements. All requirements are clear and fixed. Our project work has completed by following some strategy, which are given below:

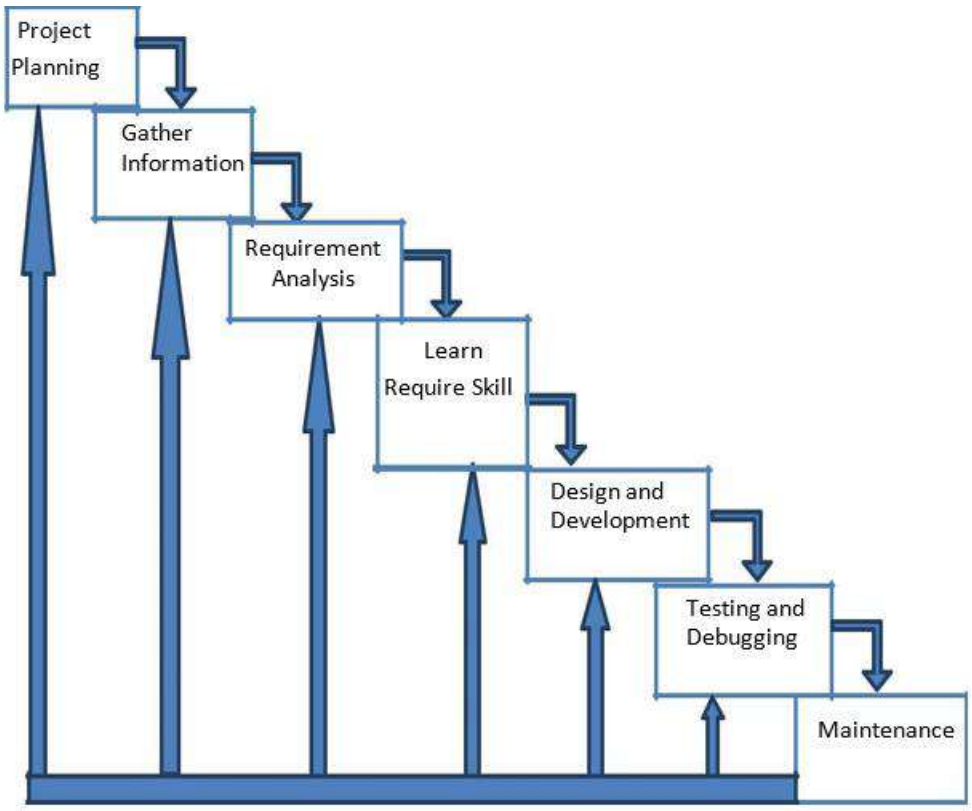



Figure 3.1: Diagram of Methodology

## 3.2 Project Planning

Project planning is a discipline for stating how to complete a project within a certain timeframe, usually with defined stages, and with designated resources. First of all we found some regular problems in our real life. Then find this problem and think to solve it by some smart way within a certain timeframe. We discussed with our team members and teachers. In order to overcome this problem, we have taken plan a smart system which can send data to nodeMCU etc. The device will help operator with some useful information which support them to controlling every equipment.

## 3.3 Gather Information

After finding problem we gathered some information about this problem that how to solve it in smartly. We read some research paper about this problem. We have collected data from industry which is based on security. Then we have found out some major problem as gas leakage, fire security, smoke detection and. We have also studied how to detect presence of human. We search in internet to find the solutions.

## 3.4 Project Analysis

The project analyst provides critical data support to a technical team. Research and analysis functions may include budget tracking and financial forecasting, project evaluation and monitoring, maintaining compliance with corporate and public regulations, and performing any data analysis relevant to project tasks. We have analyzed which type of sensor used in this system. After detect fire, we should prevent this fire automatically. So we have also used submersible pump for this project. We Also we have analyzed whether this plan is possible after it is planning and its requirements in the society and how it can be applied easily.

## 3.5 Requirement Analysis

Requirements analysis encompasses those tasks that go into determining the needs or conditions to meet for a new or altered product or project. We have used different types of components. For hardware section, we have used nodeMCU as a controller, gas sensor, fire sensor, smoke sensor, PIR motion sensor and pump etc. For coding

section, we have used Arduino platform which based on C/C$^{++}$. For building mobile application, we have found a plate which name is Thunkable. It is an online platform to build apps. We have analyzed all processing data from input device and how much take time send this data into database.

## 3.6 Learn Required Skill

For developing this project, we have learned about basic electronics, basic programming, Arduino control, IoT system and android application. We have also studied on PCB design. For programing part, we have gained lots of knowledge on C/C$^{++}$. We have learned basic working system of loop, function, conditions and algorithm. For Arduino section, we have known how connect with computer and also known Arduino language.

## 3.7 Design and Development

System design is the process of defining the components, modules, interfaces, and data for a system to satisfy specified requirements. System development is the process of creating or altering systems, along with the processes, practices, models, and methodologies used to develop them.

We have designed system architecture using NodeMCU and power supply also web interface server, Android app. We have develop the system used a Methodology here maintenance some stage.

## 3.8 Testing and Debugging

A device under test (DUT), also known as equipment under test (EUT) and unit under test (UUT), is a manufactured product undergoing testing, either at first manufacture or later during its life cycle as part of ongoing functional testing and calibration checks.

We have tested whole system in real time. We got some results and it works well. We have seen a few problem for lagging of internet.

## 3.9 Maintenance

There are some issues which come up in the client environment. To fix those issues patches are released. Also to enhance the product some better versions are released. Maintenance is done to deliver these changes in the customer environment.

The main methodology of this entire project is depends on IoT based embedded system so inter facing of all hardware with Wi-Fi and internet is very important part in its functioning.

An IoT based monitoring system used for accident detection. We place different types of sensor in industry at suitable place. All the sensors data give value through the microcontroller. For using smoke sensor and fire sensor, we can easily detect the present of fire. When fire sensor active, it gives the in microcontroller. Beside, different series of gas is also implemented so that we can find any kind of gas linkage. [9] It gives another level of security. Then motion sensor is also placed here. It gives safety security in our industry. In off time anybody enters in production house or finish goods areas, motion sensor detect human and delivered an alert alarm in our controller. All the data store in global database which is connected our mobile application. From this mobile application, we can monitor and observe whole system.

Figure 3.2: Project Preview

# CHAPTER 4

# DESIGN AND IMPLEMENTATION

Requirement Analysis: Requirement analysis is the technical analysis of a system project that is critical to success or failure. There are two Requirement analysis process.

- Hardware
- Software

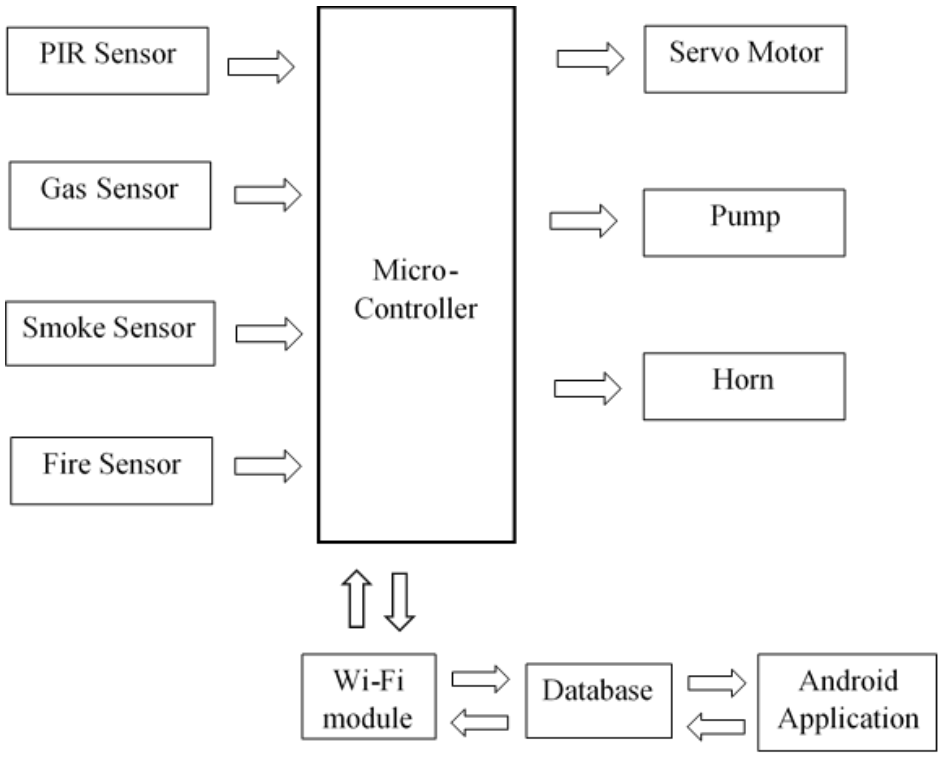



Figure 4.1: Block Diagram of Project

## ➢ Hardware Requirements

- NodeMCU - NodeMCU is an open hardware development board through which a device is designed. It acts as a microcontroller and wi-fi device.
- Power Supply- 12v DC.
- MicroUSB Cable
- PIR Sensor
- Fire Sensor

- Gas Sensor
- Smoke Sensor
- Pocket Router
- Servo Motor
- Pump
- Buzzer

## 4.1 NodeMCU

NodeMCU is an open-source Lua based firmware and development board specially targeted for IoT based Applications. It includes firmware that runs on the ESP8266 Wi-Fi SoC from Espressif Systems, and hardware which is based on the ESP-12 module. ESP 8266mod is used as a Wi-Fi module. It is attached with microcontroller. ESP8266 is Wi-Fi enabled system on chip module developed by Espressif system. It is mostly used for development of IoT (Internet of Things). This WiFi module send all the signal of our base station like a Pocket router. All the data has to be stored in a standard database. So, we are used firebase as database. First, all the input data or signal send through the Wi-Fi module. Then this data store in firebase for real time monitoring. This firebase is directly connected to our mobile application.

Figure 4.2: NodeMCU

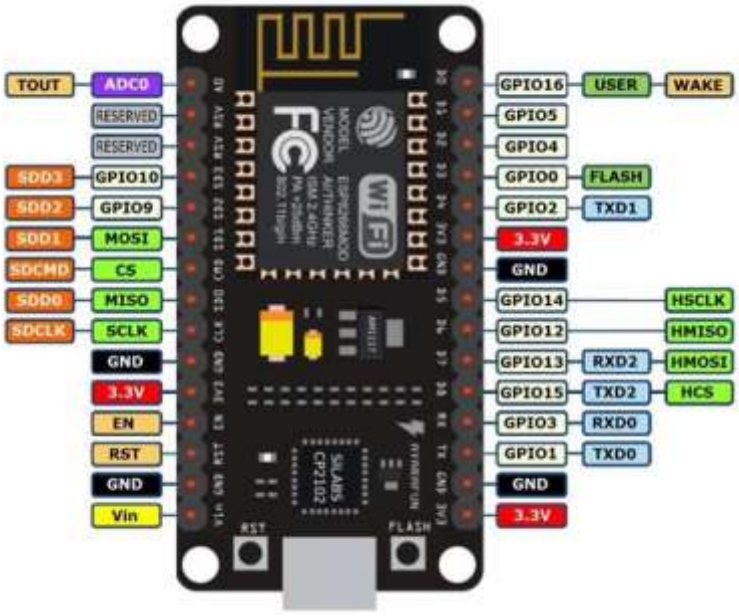



Figure 4.3: NodeMCU Pinout Diagram

## Working System:

NodeMCU is the microcontroller of this object. It has some digital pin, one Rx Tx pin and one analog pin etc. This pin is also used to control input and output devices. For analog input signal, we have only used A0 pin. For digital input signal, we have used D0-D8 pins. These pins is also used as digital output. We have connected an external power supply for activating this controller. Here, positive point of power supply connect with vin pin and negative point connect with GND pin. All the input and output devices connect with between D0 to D8. For input signal, we have declared this pin as input and for output signal we have also declared this as output.

## Pin Configuration:

- Reset Button – This will restart any code that is loaded to the Arduino board
- Ground Pin – There are a few ground pins on the Arduino and they all work the same
- Digital Input/Output – Pins 0-13 can be used for digital input or output
- USB Port – Used for powering up our Arduino and uploading sketches
- TX/RX – Transmit and receive data indication LEDs
- ATmega Microcontroller – This is the brains and is where the programs

are stored

- Power LED Indicator – This LED lights up anytime the board is plugged in a power source
- Voltage Regulator – This controls the amount of voltage going into the Arduino board
- 3.3V Pin – This pin supplies 3.3 volts of power to our projects.
- 5V Pin – This pin supplies 5 volts of power to our projects.
- Analog Pins – These pins can read the signal from an analog sensor and convert it to digital signal.

## 4.2 Power Supply-12v DC

Plug Adapter AC 100-240V to DC 12V 2A Power Supply

## Working System:

It is an external power supply for this project. This is an AC to DC converted power supply. Here DC is purified by bridge rectifier system. This power source is connected with microcontroller, input devices and output devices. All the sensor (gas sensor, PIR motion sensor, fire sensor etc.) are activated by this power supply.


Fig 4.4: Power Supply 5v

## 4.3 Motion Sensor

A motion sensor uses one or multiple technologies to detect movement in an area. When a sensor detects motion, it sends a signal to our security system's control panel, which connects to our monitoring center. We are used PIR motion sensor. It is passive infrared sensor. This sensor is connected with D3 pin. It is placed at store house in our project. It is a one kind digital sensor which gives the high (1) or low (0) value in microcontroller. When anybody comes in certain distance, then it is detected. So it gives a signal in microcontroller. Then controller is given signal to mobile application

through internet so that we can confirm the presence of human body.

Figure 4.5: Motion Sensor

## 4.4 Fire Sensor

A flame/fire detector is a sensor designed to detect and respond to the presence of a flame or fire, allowing flame detection. A flame detector can often respond faster and more accurately than a smoke or heat detector due to the mechanisms it uses to detect the flame. We are used flame sensor fire detection module for this project. It is a comparator chip LM393. We have used two fire sensor. One is placed at power house and another one is placed at production room in our project. First one is connected with D5 pin and second one is connected with is D1 pin. This sensor provide digital input value.

Figure 4.6: Fire Sensor

## 4.5 Gas Sensor

Gas sensors (also known as gas detectors) are electronic devices that detect and identify different types of gasses. They are commonly used to detect toxic or explosive gasses and measure gas concentration. Most home based smoke detection systems are oxide based sensors. MQ5 is one of the commonly used gas sensors in MQ sensor series. Different types MCQ series of gas sensor are used for project. This sensor is placed at production house. It is connected with D1 pin. This sensor also provide digital input value. When the gas exist, the sensor's conductivity gets higher value along with the gas concentration rising. Other it gives lower value absence of gas. It also gives high (1) or low (0) value in microcontroller. From this high or low


value we can easily identify gas leakage.

Figure 4.7: Gas Sensor

## 4.6 Smoke Sensor

Smoke sensor is the important portion in our industry. MQ2 is one of the commonly used gas sensors in MQ sensor series. MQ2 Gas sensor works on 5V DC and draws around 800mW. It can detect flammable gas in a range of 300 – 10000ppm. It's most common use is domestic gas leakage alarms and detectors with a high sensitivity to propane and smoke. Concentrations of gas in the gas is measured using a voltage divider network present in the sensor. This sensor activated on 5V DC voltage. This sensor is connected D2 pin. It is also placed at production sensor for detecting smoke. It also provides digital input value. A variable resistor placed in this gas sensor


module. Through this resistor serves to adjust the sensor's sensitivity and accuracy.

Figure 4.8: Smoke Sensor

## 4.7 Pump

This is a brushless submersible pump can work at 3.5V to 9V voltage, low noise, and low power consumption. This is a brushless submersible pump with USB connector, can work at 3.5V to 9V voltage, low noise, and low power consumption. It can be easily integrate to our safety security system project. The water pump works using water suction method which drain the water through its inlet and released it through the outlet. This pump is used as an output device. Positive side of this pump is connected with D7 pin. When fire will occurred in industry, it is automatically activated and provide water for extinguishing the fire.

Figure 4.9: Pump 5v

## 4.8 Servo Motor

This servo motor wheel is perfect for our robotics project. This gear box is ideal for robotic hand and controlling gate. It is a tiny and lightweight server motor with high output power. Servo can rotate approximately 180 degrees. The model of the servo motor is “SG90”. It is connected with D8 pin. It is used as output devices. It apply in our industry for controlling the gate. If any occurrence will occur in industry, it is automatically open so that worker can easily leave of industry.


Figure 4.10: Servo Motor

## 4.9 Pocket Router

A Pocket Wi-Fi works just like any internet connection device only that it is a lot smaller and portable than our traditional home Wi-Fi router. The device then omits a Wi-Fi signal just like your home Wi-Fi does, allowing any of our internet capable

devices to connect via Wi-Fi. It works just like any internet connection device only thait is a lot smaller and portable than your traditional home WiFi router. Unlike the latter the mobile WiFi is designed for use without location constraint, allowing you to stay connected to the web wherever we may find ourselves.


Figure 4.11: Pocket Router

## 4.10 Buzzer

This is a Small PCB Mountable 12V Active Electromagnetic Buzzer. It is great to add Audio Alert to your electronic designs. It operates on 12V supply, uses a coil element to generate an audible tone. It is also used as output device. Basically it is an alarm system. When fire occur in industry, then it will activate. It is connected with D6 pin

of microcontroller.

Fig 4.12: Buzzer 12v

- Software Requirements:

Our whole system are controlled by Arduino. Different types of logic develop through Arduino platform. All sensors and output device controlled this language. Developing this language, we are used Arduino IDE software.

## 4.11 Programming on Arduino

After completing our circuit design and built our hardware section, we developing coding or programming on Arduino. This Arduino software is easy-to-use for beginning level, yet flexible enough for advanced users. Once the circuit has been created on the breadboard, we'll need to upload the program to the Arduino.


Figure 4.13: Opening Arduino IDE


Figure 4.14: Sketch of Arduino IDE

When we opened this software, we see this format. From this menu bar, we see that this is Arduino 1.8.1 version. We are also seen different types of such as file, sketch,

tools etc.

• Menu Bar: Gives us access to the tools needed for creating and saving Arduino sketches.

• Verify Button: Compiles our code and checks for errors in spelling or syntax.

• Upload Button: Sends the code to the board that's connected such as Arduino Uno in this case. Lights on the board will blink rapidly when uploading.

• New Sketch: Opens up a new window containing a blank sketch.

• Sketch Name: When the sketch is saved, the name of the sketch is displayed here.

• Open Existing Sketch: Allows us to open a saved sketch or one from the stored examples.

• Save Sketch: This saves the sketch we have currently opened.

• Serial Monitor: When the board is connected, this will display the serial information of our Arduino

• Message Area: This area tells us the status on saving, code compiling, errors and more.

• Text Console: Shows the details of an error messages, size of the program that was compiled and additional info.

• Board and Serial Port: Tells us what board is being used and what serial port it's connected to.

• Code Area: This area is where compose the code of the sketch that tells the board what to do. There has two portion void setup () and void loop (). The code that we put inside void setup () will only run once, and that will be at the beginning of our program. One example is when we want to turn our robot on that does not happen multiple times! In void loop (), our code will repeat over and over again.

## 4.12 Board and port selection of Arduino

Once the software has been installed on our computer, go ahead and open it up. This is the Arduino IDE and is the place where all the programming will happen. Take some time to look around and get comfortable with it.

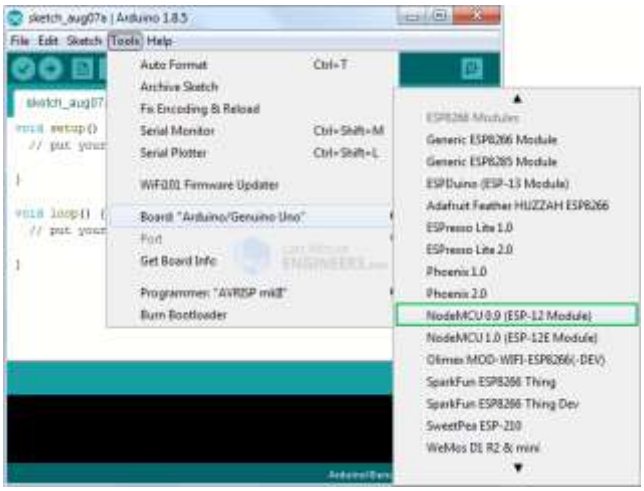
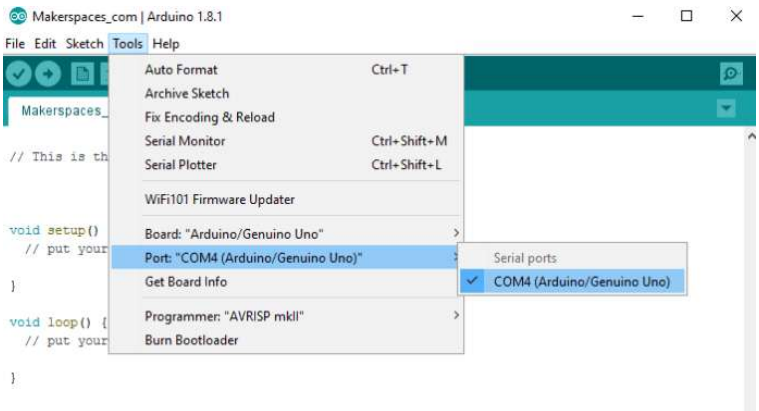



Figure 4.15: Arduino Board Selection

At this point we are ready to connect our Arduino to our computer. Plug one end of the USB cable connect to the nodeMCU and then the other end of the USB to our computer's USB port. Once the board is connected, we will need to go to Tools then Board then finally select nodeMCU.

Next, we have to tell the Arduino which port we are using on our computer. To select




the port, go to Tools then Port then select the port that says Arduino.

Figure 4.16: Arduino Port Selection

## 4.13 Connect the Parts

We can build our Arduino circuit. We are connected our input and output with nodeMCU. DC power supply also connect with nodeMCU to activate this controller. For input device, we declare D0, D1, D2, D3 and D5 as INPUT_PULLUP. D0 and D5 pin connected with fire sensor which located with power house and production house. D1 and D2 pin connected with gas sensor and smoke sensor. Finally D3 pin connected with PIR motion sensor. For output device, we declare D6, D7 and D8 as OUTPUT. D6 and D7 pin connected with buzzer and pump. And D8 pin attach with servo motor.

## 4.14 Compiling and Uploading System of Arduino

Next, we need to click on the verify button (check mark) that's located in the top left of the IDE box. This will compile the sketch and look for errors. Once it says "Done Compiling" we are ready to upload it. Click the upload button (forward arrow) to send


the program to the Arduino board.

Fig 4.17: Pin Mode Setup


Figure 4.18: Verify & Upload Button

If we don't select our port and board in right way, there has shown in some error. This error show in output pane. So at first we should check this output pane. Then fixed this error.

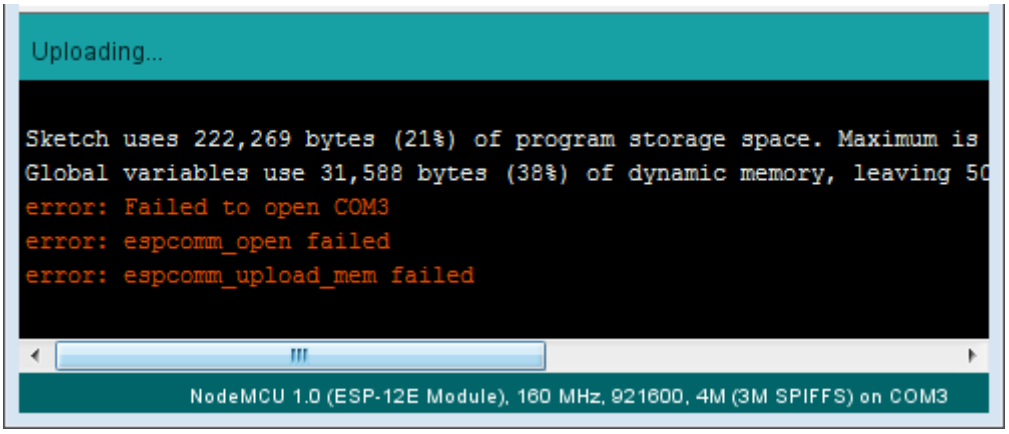


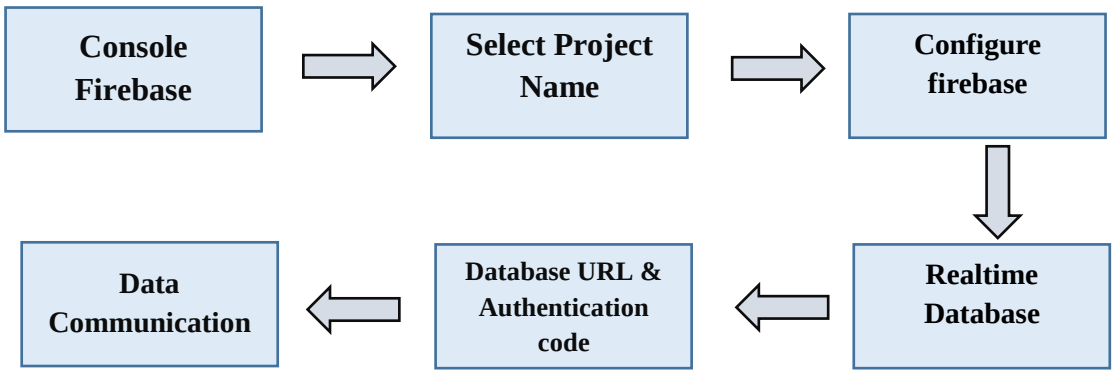

Figure 4.19: Error Show in Output Pane.

# CHAPTER 5

# DATABASE MANAGEMENT

## 5.1 Introduction

A database is an organized collection of structured information, or data, typically stored electronically in a computer system. Database is developed for storing signal from the sensors. Because it stores in globally. In this time firebase used for database system. Firebase is a platform developed by Google for creating mobile and web applications. This is the flow chart of creating a project in firebase.




## 5.2 Console Database

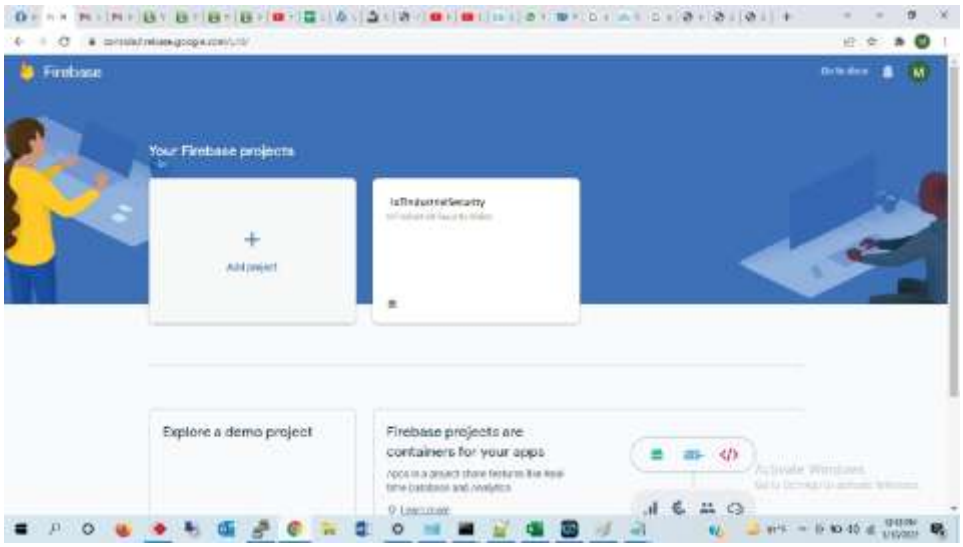
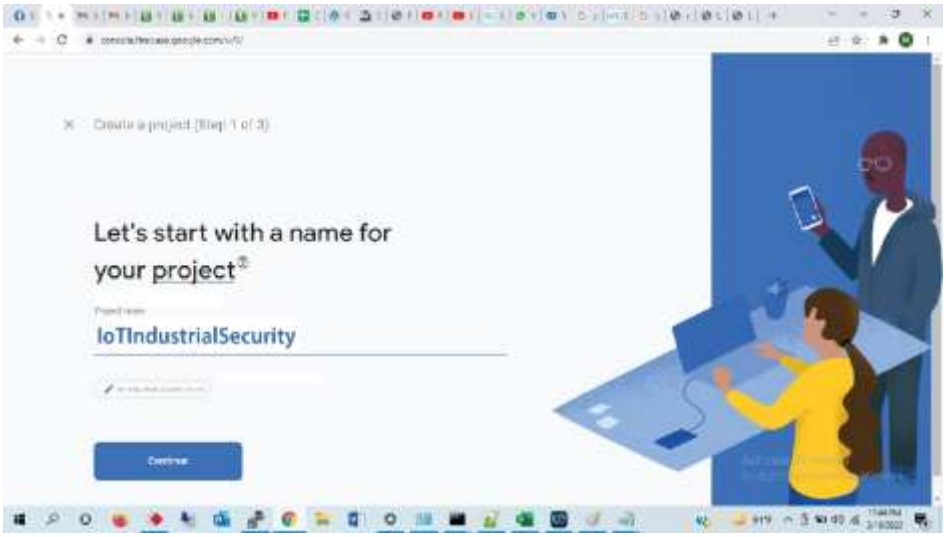



Fig 5.1: Console Database

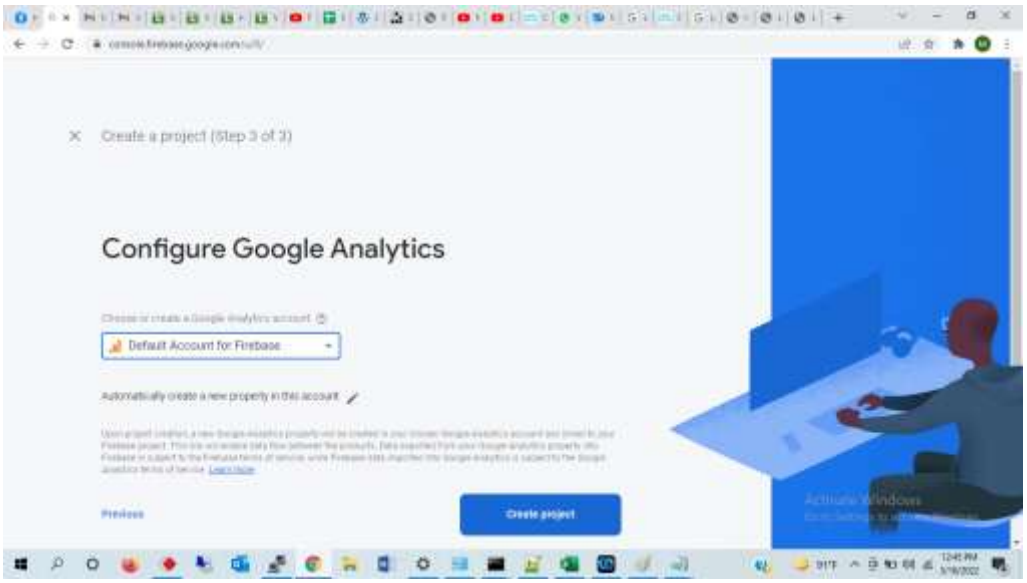
At first, console this firebase. Initially this page open for creating a project in this database. New project creates in the firebase from add project option.




5.3 Project Name Select

Fig 5.2: Project Name Selection

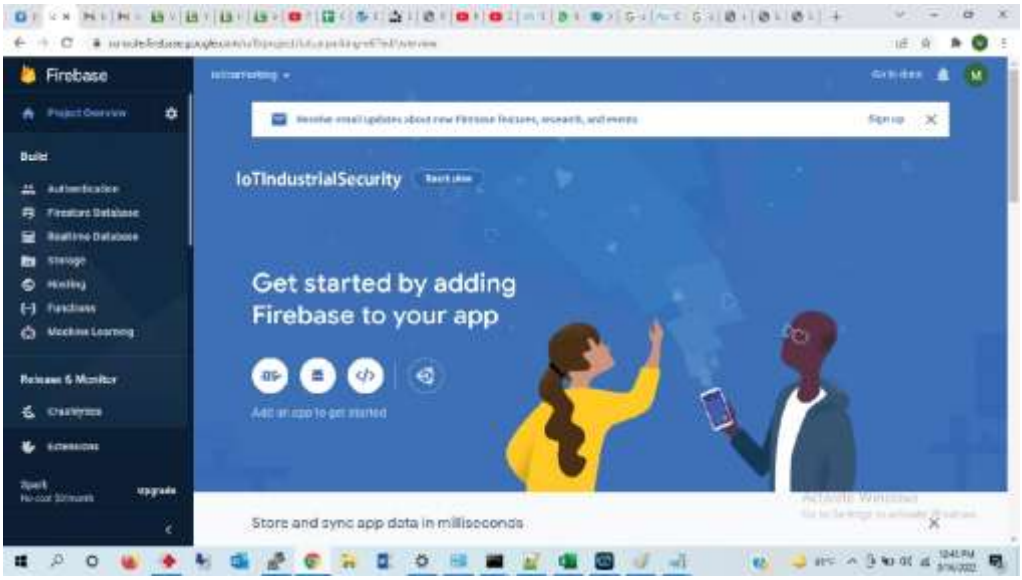
This was creating a project in this database. Project name was given here. Name of the project was “IoTIndustrialSecurity”. Then a project was created by this name.




5.4 Configure Database

Fig 5.3: Configure Database

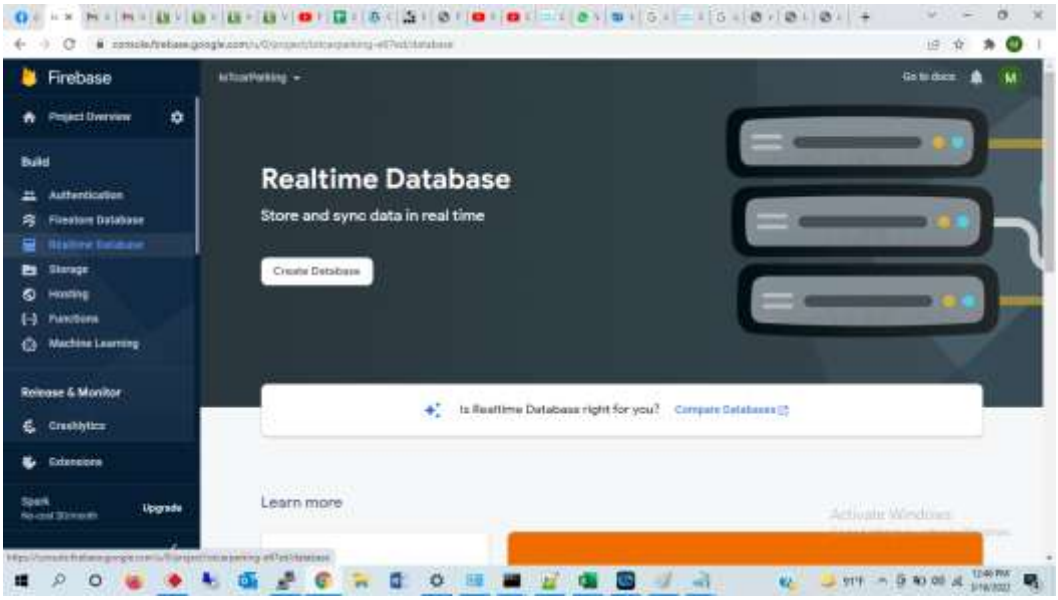
After configure this database. We configured our database as a default account for




firebase.

Fig 5.4: Dashboard of Database

Then this dashboard was opened. Different types of database options are shown in this board.




5.5 Realtime Database

Fig 5.5: Realime Database Selection

Realtime database is selected for monitoring real time data. It is selected from the left side dashboard.

## 5.6 Database URL and Authentication Code

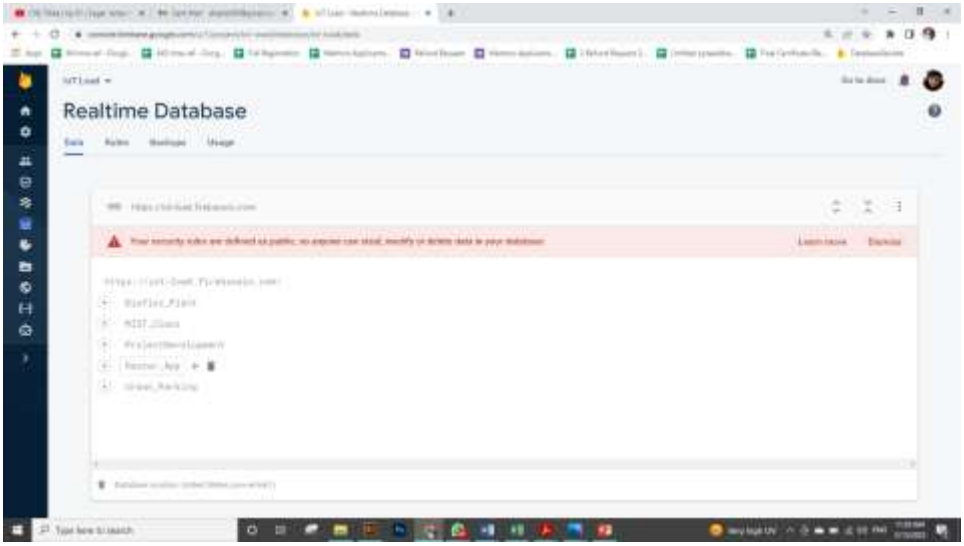



Fig 5.6: Database URL

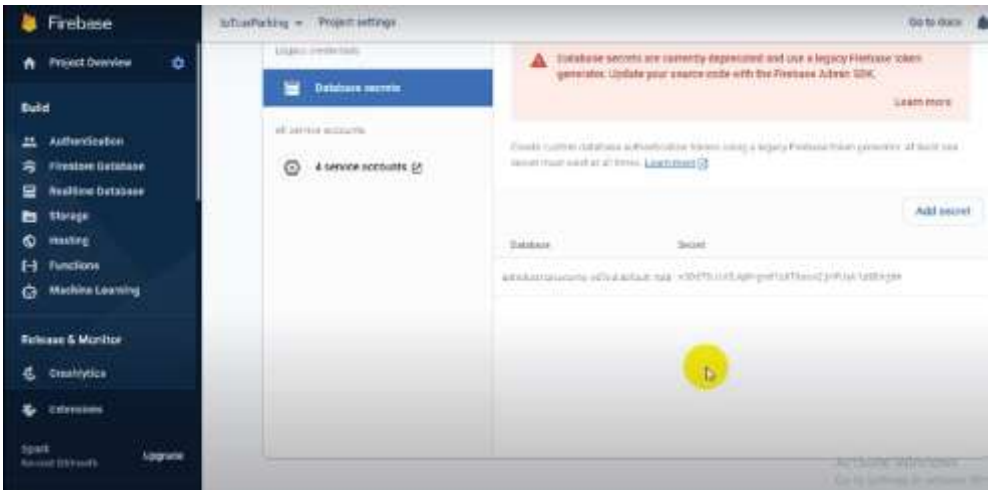
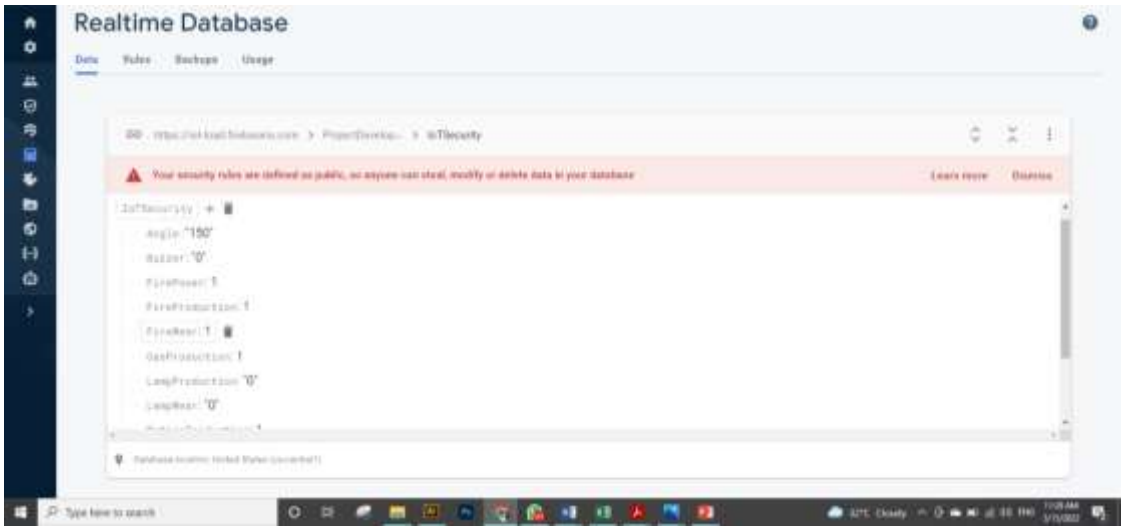



Fig 5.7: Database Authentication Code

Database URL and database authentication code were shown here. Firebase initialized in Arduino with help of this URL and code. Through this URL micro-controller connected with particular database and transferred data in firebase.




## 5.7 Data Communication

Fig 5.8: Data Communication System

Real time data communication system was developed here. This data come into the firebase as an integer. But it also come as a string and character. This system was built with tag and value. In this database Angle, Buzzer, FirePower, FireProduction, GasProduction etc. were represented the tag. These are found as a string. But value was one kind of signal which came from the sensor via controller. When any car was placed on slot, the value was zero (0). Again when car was not placed there, the value was one (1). These were changed with respect to the value of sensors.

# Chapter 6

# APPS DEVELOPMENT

## 6.1 Introduction

We develop an app for monitoring this project. It is an android app. It is a user friendly app. This app is built with help of MIT app inventor platform. It is an intuitive, visual programming environment that allows everyone to build fully functional apps for Android phones, iPhones, and Android/iOS tablets. Blocks-based coding programs inspire intellectual and creative empowerment. In this app, four parking slot are shown here.

## 6.2 Front Page Design

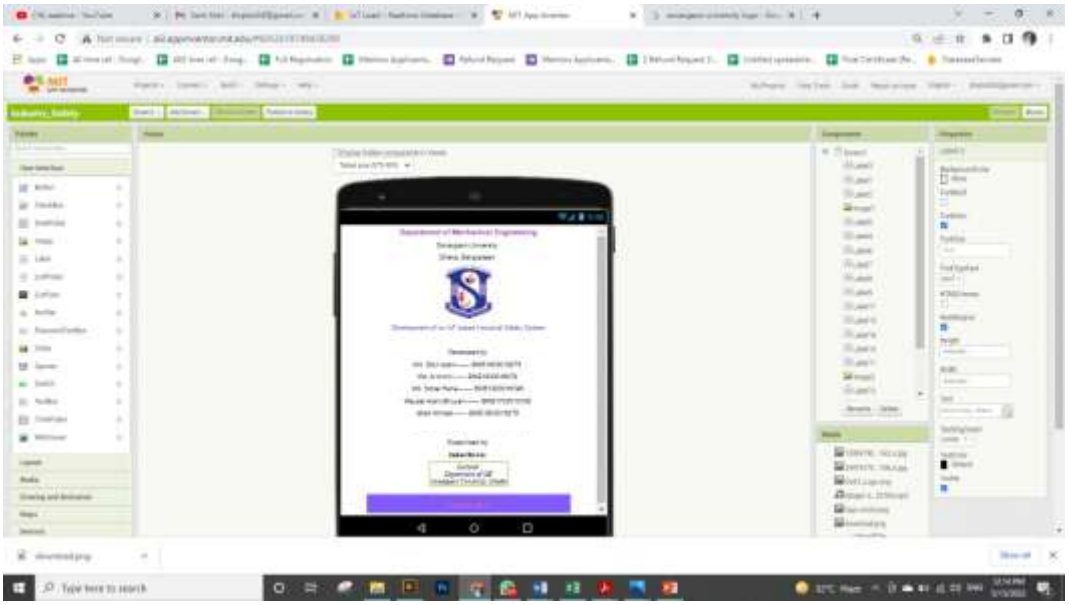


Fig 6.1: Front Page Develop at MIT Platform

This is the main front page of this project. This is built by block programing in MIT app inventor. All most every information's are given here. It is an IoT based industrial security system and cloud monitoring app which is shown here in title name of this app.


Fig 6.2: Mobile View of Front Page


This is the mobile view of the front page. Go to Dashboard indicates to go the next page of this app

Fig 6.3: Block Diagram of Home Page Design

This is the home screen block diagram. In this apps, any block come to the apps by using this label and text use for renaming this sensor name.

## 6.3 Monitoring Page Design

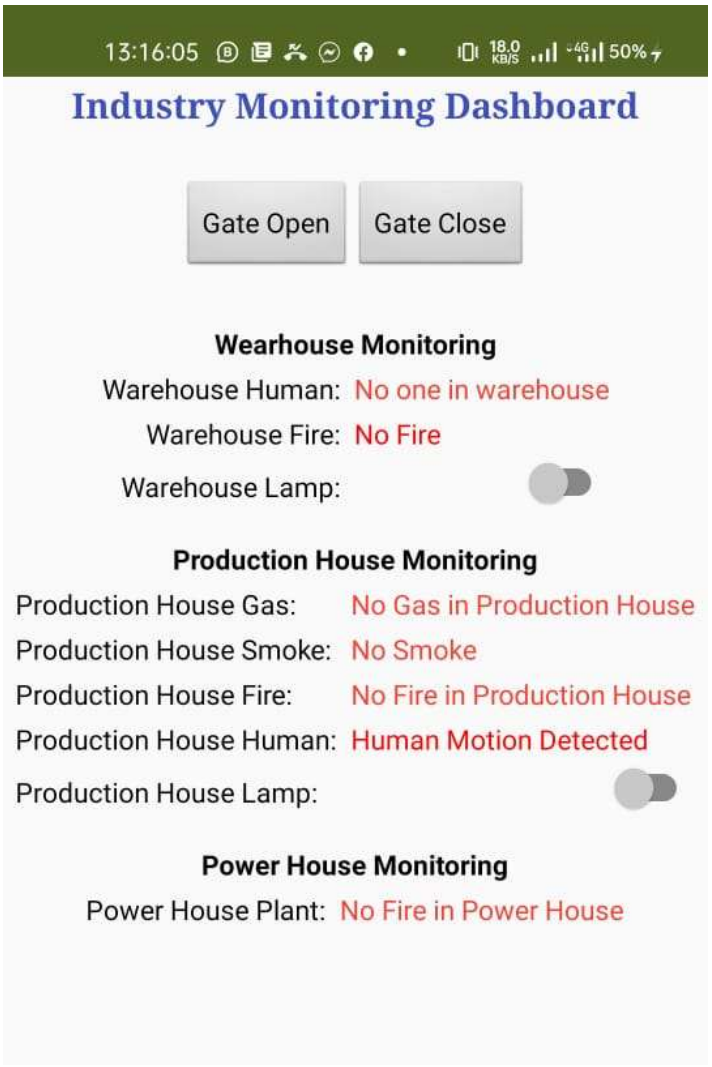



Fig 6.4: Mobile View of Monitoring Page

From this page, we monitored our project. Real time position of sensors and output devices were showed here. The value of page was changed with respect to environment. This is the initial view of the apps. Besides ware house lamp and production house was also off from this apps.

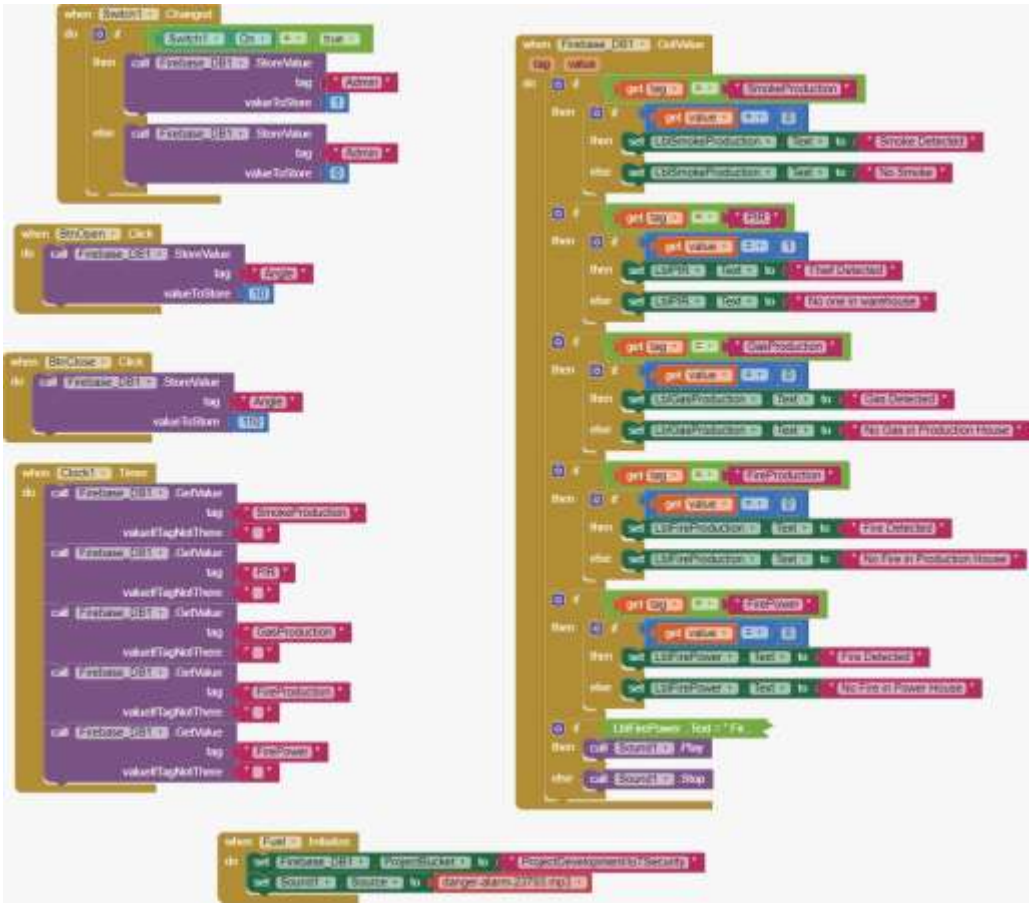


Fig 6.5: Block Diagram of Monitoring Page

For developing this apps, real clocking system was used. A simple condition was applied which if and else to customized this apps. In this diagram get function worked as input from sensor and set function used to show this value in apps. Tag represented which sensor are called for this project.

# CHAPTER 7

# RESULT & DISCUSSION

## 7.1 Result:

After analyzing this project, we were found different types of result.

- **Time:** We knew that microcontroller took some time for processing the signal. Here all this data is worked through the internet. So, processing time depended on the Internet speed. When Wi-Fi module crossed the High internet speed zone or connected with high band width, it took time 3sec to 5sec. Otherwise, it took 5sec to 12sec. Sometimes controller disconnected with our database for poor connection.

- **Accuracy:** Accuracy of the project was so good. In our observation time, it was performed accurately. But few times it was failed for poor connection.

- **Limitations:** There was different kind of limitations.

  - We could detect the leakage of gas. But we don't identify the actual leakage point in industry. So this time we need some time to prevent this problem.
  - Here, we only detect the fire after something burned. If we know reason of fire before burning, then it will be more applicable for our industry.
  - Using PIR sensor, we identify the presence of human. But this sensor also detect the animal. So sometime it creates troubles in monitoring system.

- **Future Work:** We can more accurate and valuable by adding this type of future work.

- We can attach camera in industry. Doing image processing, we can observe every movement of worker. When something will wrong, it will gives a signal in controller. So authority easily know everything.
- This image processing system also benefit to detect human at finishing good room. Applying this system, authority will easily know which person enter the finishing goods room area.
- Applying this system, authority will identify the gas leakage point in industry. It will decrease our accident. From this technology, unconscious worker will also find. Then we will give message for his/her unconscious behavior.

## 7.2 Discussion:

We have developed industrial security system and accident monitoring. This project can develop with help of our supervisor. He guide us proper way. Withed the co-operation of microelectronics technology, we can apply electronics and programmable related device within an automobiles several systems where it could increase the efficiency, security and longevity of an automobile as well as providing digitalize service for consumers. Doing this project, we can gain electronics knowledge and work hardware software combination. We learned programing C and also Arduino programing. Within this project we have tried to show gas detection, fire detection, flame detection and also detect human. Each output data authority can know all of it through mobile application. We optimize, the mobile application and the systems would be more beneficial for owners. As commercially we can get scopes for attaching or installing our project, it will must secure our industry, reduce maintenance cost and look after from wherever wants. Each system of this project is customer demands from the field study we have abled to understand. So we have inspired to develop this project. These safety concepts a better safe work environment can be provided to the workers and the productivity will automatically get improved.

# CHAPTER 8

# CONCLUSIONS

Our proposed IoT based design for a real-time industrial security system, monitoring and reduce accident. Our primary goal was to extend a solution that would allow authority to monitor each place in industry, from a central location using an IoT based infrastructure. The study has shown that employee's safety is more important and is highly recommended to all manufacturing industries. Using sensors, we get more real time data from microcontroller. In this the root cause for the fire is identified at the basic stage, from that the major fire accidents and damage to lives are avoided. Industrial safety security systems are highly relevant in these days and this project aims at developing a low cost solution for the same for the benefit of the society. This study is taken as a ground work to improve safety management on manufacturing industries.

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# APPENDIX

```
//Smoke: D7
//Gas: D6
//FactoryFire: D5
//Pump: D1
//Motor: D2
//GateServo: D8



#include "FirebaseESP8266.h"
#include <ESP8266WiFi.h>
#include <Servo.h>

#define FIREBASE_HOST "iot-load.firebaseio.com"
#define FIREBASE_AUTH "Jnq5ikOjpEl0G2atw5Q6oI8wdLUi1UvtixTPQEGj"
#define WIFI_SSID "Vehicle"
#define WIFI_PASSWORD "12345678"
int Connector=D4;
Servo myservo;

FirebaseData firebaseData,loadData;
FirebaseJson json;

int loadR(String field)
  {
    if (Firebase.getString(loadData, "/ProjectDevelopment/SmartIndustry/"+field))
    {
```

```
    return loadData.stringData().toInt();
   }
  }

void setup() {
  pinMode(D1,OUTPUT);
  pinMode(D2,OUTPUT);
  pinMode(D8,OUTPUT);

  pinMode(D5,INPUT_PULLUP);
  pinMode(D6,INPUT_PULLUP);
  pinMode(D7,INPUT_PULLUP);
  myservo.attach(D8);

  Serial.begin(9600);
  pinMode(Connector,OUTPUT);
  WiFi.begin(WIFI_SSID, WIFI_PASSWORD);
  Serial.print("Connecting to Wi-Fi");

  while (WiFi.status() != WL_CONNECTED)
  {
   digitalWrite(Connector,1);
   Serial.print(".");
   delay(200);
   digitalWrite(Connector,0);
   Serial.print(".");
   delay(200);

  }
```

```
  Serial.println();
  Serial.print("Connected with IP: ");
  Serial.println(WiFi.localIP());
  Serial.println();

  Firebase.begin(FIREBASE_HOST, FIREBASE_AUTH);
  Firebase.reconnectWiFi(true);



}


void loop() {
  if(WiFi.status() != WL_CONNECTED)
  {
     while (WiFi.status() != WL_CONNECTED)
       {
         digitalWrite(Connector,1);
         Serial.print(".");
         delay(200);
         digitalWrite(Connector,0);
         Serial.print(".");
         delay(200);
    }
  }

  if(digitalRead(D5)==0) Firebase.setString(firebaseData,
"/ProjectDevelopment/SmartIndustry/Pump","1");
  else Firebase.setString(firebaseData,
"/ProjectDevelopment/SmartIndustry/Pump","0");
```

```
  Firebase.setInt(firebaseData,
"/ProjectDevelopment/SmartIndustry/FactoryFire",digitalRead(D5));
  Firebase.setInt(firebaseData,
"/ProjectDevelopment/SmartIndustry/Gas",digitalRead(D6));
  Firebase.setInt(firebaseData,
"/ProjectDevelopment/SmartIndustry/Smoke",digitalRead(D7));


  if(digitalRead(loadR("Gate"))==1) myservo.write(100);
  else myservo.write(10);


  digitalWrite(D2,loadR("Motor"));
  digitalWrite(D1,loadR("Pump"));
  delay(50);

}



//Power House Fire: D7
//WearHouse Fire: D6
//WearHouse Motion: D5
//Gate: D1
//Slot1: D2
//Slot2: D3
//Slot3: D4

#include "FirebaseESP8266.h"
#include <ESP8266WiFi.h>

#define FIREBASE_HOST "iot-load.firebaseio.com"
#define FIREBASE_AUTH "Jnq5ikOjpEl0G2atw5Q6oI8wdLUi1UvtixTPQEGj"
#define WIFI_SSID "Vehicle"
```

```
#define WIFI_PASSWORD "12345678"
int Connector=D0;

FirebaseData firebaseData;
FirebaseJson json;



void setup() {
  pinMode(D1,INPUT_PULLUP);
  pinMode(D2,INPUT_PULLUP);
  pinMode(D3,INPUT_PULLUP);
  pinMode(D4,INPUT_PULLUP);
  pinMode(D5,INPUT_PULLUP);
  pinMode(D6,INPUT_PULLUP);
  pinMode(D7,INPUT_PULLUP);

  Serial.begin(9600);
  pinMode(Connector,OUTPUT);
  WiFi.begin(WIFI_SSID, WIFI_PASSWORD);
  Serial.print("Connecting to Wi-Fi");

  while (WiFi.status() != WL_CONNECTED)
  {
    digitalWrite(Connector,1);
    Serial.print(".");
    delay(200);
    digitalWrite(Connector,0);
    Serial.print(".");
    delay(200);
```

```
  }

  Serial.println();
  Serial.print("Connected with IP: ");
  Serial.println(WiFi.localIP());
  Serial.println();

  Firebase.begin(FIREBASE_HOST, FIREBASE_AUTH);
  Firebase.reconnectWiFi(true);



}



void loop() {
  if(WiFi.status() != WL_CONNECTED)
  {
     while (WiFi.status() != WL_CONNECTED)
       {
         digitalWrite(Connector,1);
         Serial.print(".");
         delay(200);
         digitalWrite(Connector,0);
         Serial.print(".");
         delay(200);
    }
  }
```

```
  Firebase.setInt(firebaseData,
"/ProjectDevelopment/SmartIndustry/Slot1",digitalRead(D2));

  Firebase.setInt(firebaseData,
"/ProjectDevelopment/SmartIndustry/Slot2",digitalRead(D3));

  Firebase.setInt(firebaseData,
"/ProjectDevelopment/SmartIndustry/Slot3",digitalRead(D4));

  Firebase.setInt(firebaseData,
"/ProjectDevelopment/SmartIndustry/WearMotion",digitalRead(D5));

  Firebase.setInt(firebaseData,
"/ProjectDevelopment/SmartIndustry/WearFire",digitalRead(D6));

  Firebase.setInt(firebaseData,
"/ProjectDevelopment/SmartIndustry/ControlFire",digitalRead(D7));


}
```