A Major Project

on

PRESENCE ALERT SYSTEM

SUBMITTED IN PARTIAL FULFILLMENT OF THE REQUIREMENT FOR THE AWARD OF THE DEGREE OF

BACHELOR OF TECHNOLOGY

(Electronics & Communication Engineering)

JUL-DEC, 2021

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DEPARTMENT OF ELECTRONICS & COMMUNICATION ENGINEERING

GURU NANAK DEV ENGINEERING COLLEGE LUDHIANA

An Autonomous College Under UGC ACT

CANDIDATE DECLARATION

I hereby certify that the work which is being presented in the Project entitled "PRESENCE ALERT SYSTEM" by "RAVISHANKAR KUMAR" in partial fulfillment of requirements for the award of degree of B-Tech (Electronics and Communication Engineering) submitted to the Department of Electronics and Communication Engineering at GURU NANAK DEV ENGINEERING COLLEGE, LUDHIANA is an authentic record of my own work carried out during a period from JULY 2021 to DEC 2021. The matter presented in this project has not been submitted by me or anybody else in any other University / Institute for the award of B-Tech Degree.

Signature of student:

This is to certify that the above statement made by the candidate is correct to the best of my own knowledge.

(Signature of Project Guide/Guides)

The Major Project Viva-Voce Examination of_____has been held on_____and accepted.

Signature of Internal Examiner **Signature of External Examine**

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ABSTRACT

Security is a very important need in the daily life. In most developing regions of the world,the rate of kidnapping especially semi-urban areas has increased in recent times. This paper presents the design and prototyping of presence alert system. QR code attached to dress of child will be scanned by scanner. Information collected from QR code will be gathered in GSM. GSM will automatically send message to corresponding registered mobile numbers and emails. The ESP32 cam is used to scan the QR code. Once an QR was detected by the ESP32 cam, GSM will send an alert SMS message or Email to registered ids. The proposed system accurately scans and inform the presence of kids in school.

ACKNOWLEDGEMENT

We take this opportunity to express our profound sense of gratitude and respect to all those who had helped us throughout the duration of this project session. We acknowledge the efforts of those who have contributed significantly to our project.We feel privilege to offer our sincere thanks and deep sense of gratitude to our principal, Dr. Sehajpal Singh and our HOD Dr. Ameeta Sehra and also our ProjectGuide, for expressing their confidence in us and gave us the wonderful knowledge of the upcoming techniques in implementing this project. We thank our branch teachers and faculties of "Electronics and Communication" for their suggestion and information relating to our project.

LIST OF FIGURES

DEFINITIONS, ACRONYMS AND ABBREVIATIONS

1.Microcontroller: - A microcontroller is an integrated circuit (IC) device used for controlling other portions of an electronic system, usually via a microprocessor unit (MPU), memory, and some peripherals. These devices are optimized for embedded applications that require both processing functionality and agile, responsive interaction with digital, analog, or electromechanical components.

2.Sensor: - A sensor is a device that detects and responds to some type of input from the physical environment. The specific input could be light, heat, motion, moisture, pressure, or any one of a great number of other environmental phenomena. The output is generally a signal that is converted to human-readable display at the sensor location or transmitted electronically over a network for reading or further processing.

3.Data processing: -Data processing is the method of collecting raw data and translating it into usable information. It is usually performed in a step-by-step process by a team of data scientists and data engineers in an organization. The raw data is collected, filtered, sorted, processed, analyzed, stored and then presented in a readable format.

4.IDE: - Integrated development environment

5.PWS: - Personal Web Server

6.IoT: - Internet of Things

CHAPTER 1

INTRODUCTION & PROJECT FORMULATION

1.1 OVERVIEW

world is growing so fast crime like kidnapping is also increasing, No one know what will happen next whether it is good or bad If it is bad then we cannot ignore kidnapping of kids for ransom and sometimes kidnappers do their works to the kids beside the ransom Due to this the parents of the children who attend school for their education and if the school is little far from their home and using school bus to go to the school always feel insecure till they come back to the home after the school basically they feel burden due to this type of happening day by day. To overcome this type of burden on the parents and the school guardian we have kids' safety device which will inform the parents about whether the student reached school or left from the school.

1.2 EXISTING SYSTEM

In the 21st century, everything around us has become depends upon technology to make our life much easier. Daily tasks are continuously becoming computerized. Nowadays more people prefer to do their work electronically. To the best of our knowledge, the process of recording students' presence at the school is still manual. Staffs go through manual attendance sheets and signed papers to record presence. This is slow, inefficient and time consuming. The main objective of this project is to offer system that simplify and automate the process of recording and tracking students' attendance through GSM based scanner technology. It is biometric technology to identify or verify a person from a QR code. Cam scanner is widely used nowadays in different areas such as banks, airports, and offices. We will use preprocessing techniques to detect, recognize and verify the scanned like Eigenfaces method. We aim to provide a system that will make the presence process faster and more precisely.

1.3 USER REQUIREMENTS ANALYSIS

limits and also whether their child have reached to their particular destination safely Nowadays parents are very conscious about their children safety. So, whenever their children are outside oftheir house, they are constantly worried about the safety of their wards so in order to get current situation of their wards they constantly try to call their wards to get the latest update. Parents areworried for their safety of wards because in these recent times crime rates have reached to their or not.

1.4 FEASIBILITY STUDY

It is easy to implement as technologies which we are about to use is easy to handle and mode ratable. It will be of low cost so it can be afforded by anyone. Because it is for the kids & will be solely based on guardians' permission and data will be stored at the schoolserver (in present data of kids are stored in the server too) & notification will send to the guardian of the respective child so there shouldn't be any legal issue. As we will use IOT (Internet of Things) so writing codes will be feasible.

1.5 OBJECTIVE OF PROJECTS

1. Our system should detect QR code.
2. Our system should be able to send SMS and Emails to the registered wards parents.
3. Our system should able to map correctly the scanned QR code data to the already saved data in a database

CHAPTER 2 PROJECT DESIGN

2.1 PROJECT PERSPECTIVE

The whole system will be controlled using an Arduino UNO board. GSM module will beused to communicate the message to parents. SIM card will be used to in the GSM module. The system is designed to operate manually or automatically. The system automatically sends the SMS or EMAIL to the registered ward parents.

2.2 PROJECT FUNCTION

As our project title is presence alert system. And here we focus mainly on the studentconcerns. So here I am going to describe some overview about steps followed in this project.

STAGE 1: - Here firstly we design a batch including a QR code for students and in QRcode we assign mobile no of his/her parents.

STAGE 2: - At stage 2 we will keep an ESP-32 cam sensor that is used for scanning purpose and sending a signal to our GSM 900A module.

STAGE 3: - At stage 3 we assign a GSM 900A module which are used for sending message to given specific number.

STAGE 4: - At stage 4 the parents will receive the message at their phone.

2.3 USER CHARACTERISTICS

limits and also whether their child have reached to their particular destination safely Nowadays parents are very conscious about their children safety. So, whenever their children are outside of their house, they are constantly worried about the safety of theirwards so in order to get current situation of their wards they constantly try to call their wards to get the latest update. Parents are worried for their safety of wards because in these recent times crime rates have reached to their or not.

2.4 CONSTRAINTS

2.4.1 ADOPTION OF ALERT AND WARNING SYSTEM

The lack of adoption by alert originators (AOs) of the full Integrated Public Alert and Warning System (IPAWS) capabilities is problematic as more and more of the public relies on cell phones for the majority of their communication. Two—of potentially several—reasons for lack of adoption include system costs for jurisdictions and message originators' education, but even those with access to the IPAWS gateway can be hesitant to use the system. An effort to understand and address barriers to adoption will need to be undertaken. The social science community's knowledge around public response needs to be exploited when creating messages or using the system. It is important to note the wide diversity in potential message originators. For smaller jurisdictions and organizations, sending alerts may be a part-time job, and a person may only be active in the emergency response community during events; in the largest jurisdictions or organizations, public alerting may be the responsibility of a large team of individuals who are trained emergency management professionals immersed in disaster response full time.

2.4.2 EVER CHANGING TECHNOLOGY

Technology and communications tools used by the public are quite dynamic. The technology itself evolves quickly, and with a growing smartphone application market, the applications used by individuals can quickly change. Alert and warning systems must evolve to make use of these new technologies. This supports the need for a flexible, integrated system. However, adding to this challenge is that old and new technologies coexist for long periods of time and technologies come in and out of favour. A primary example is broadcast over-the-air television. Although usage of over-the-air television began to decline as cable was adopted, use as shown a slight increase as "cord-cutters" rely more heavily on streaming services.

2.5 METHODOLOGY

- The whole system is controlled by using an Arduino Uno R3, GSM SIM 900A, ESP 32 Cam sensor mainly.
- We have used ESP 32 Cam module for purpose of scanning any QR code and it is established at the first place of our project.
- We have used Arduino Uno R3 that is a microcontroller, by using this we can program our ESP32 Cam sensor and GSM SIM 900A and we can give them instruction according to our requirements.
- After successful scanning of QR code our ESP 32 cam sensor sends a signal to our GSM SIM 900A that used to send the data to a specific no according to prescribed instruction. Here we already stored the data in a memory and after scanning the data matched with stored data and if the data will match then it will send to specific location.

2.6 Equipment and apparatus required

- Arduino
- GSM module
- GSM antenna
- ESP-32 cam Scanner
- Memory Card
- Battery/direct connection for power supply

2.7 Assumptions and Dependencies

In this project we will not be able to monitor other conditions like capturing the image , etc. Personnel costs will not change during the project cycle. All the hardware components are assumed to be properly working. Chances of error is also taken in condition as these are the hardware which have some uncertainty in them.

CHAPTER 3
DEVELOPMENT AND IMPLEMENTATION

3.1 INTRODUCTION TO TOOLS (SOFTWARE/HARDWARE)

3.1.1 SIM 900A

SIM900A Modem is built with Dual Band GSM/GPRS based SIM900A modem from SIMCOM. It works on frequencies 900/ 1800 MHz SIM900A can search these two bands automatically. The frequency bands can also be set by AT Commands. The baud rate is configurable from 1200-115200 through AT command. The GSM/GPRS Modem is having internal TCP/IP stack to enable you to connect with internet via GPRS. SIM900A is an ultra-compact and reliable wireless module. This is a complete GSM/GPRS module in a SMT type and designed with a very powerful single-chip processor integrating AMR926EJ-S core, allowing you to benefit from small dimensions and cost-effective solutions.

SIM900A GSM Module Pin Configuration Description

GPIO Pins

The GPIO pins help to perform the simple and advance I/O function. All pins give the maximum output equal to the power supply which is useable to control most of the devices like sensors and other modules. All GPIO pins in SIM900A are:

- GPIO1 – Pin40
- GPIO2 – Pin41
- GPIO3 – Pin42
- GPIO4 – Pin43
- GPIO5 – Pin44
- GPIO6 – Pin47
- GPIO7 – Pin48

- GPIO8 – Pin49
- GPIO9 – Pin50
- GPIO10 – Pin51
- GPIO11 – Pin67
- GPIO12 – Pin68

SIM900A Display Interface Pins

The device offers a 4-pin display interface with itself. The display isn't necessary, it is only in case of requirement. The use of interface helps to get the visualization with the module and make it an application. All display pins are:

• DISP_DATA – Pin12 – For Display Data

• DISP_CLK – Pin11 – For Clock Input

• DISP_CS – Pin14 – To enable the display

• DISP_D/C – Pin13 – To select between data and command

I2C Pins

SIM900A has multiple kinds of communication and I2C is one of them due to is popularity. The module has a single I2C protocol pin, which helps to build the application with any module withthat communication.

SCL – Pin38

SDA – Pin37

SDA for data and SCL for clock pulse.

SIM900A GSM Module Keypad interface Pins

The two-pin keypad is interfaceable with the module. The module will take the keypad data as a2D matrix value from the KCB pins for each value. The keypad interface pins in the module are:

KBR0~KBR4 (ROWS) – Pin40~Pin44

KBC0~KBC4 (COLUMN) – Pin47~Pin51

Serial Port

The UART serial interface uses the two pins for proper data communication, which are RX and TX. Both pins have no independence on any other pins or modules. In SIM900A these pins are available but it also has some other pins for status/indication of data. By combining these pins, theserial port helps to generate the RS-232 connector too. All the serial pins are:

RXD – Pin10 – To receive the data

TXD – Pin 9- To send the data

RTS – Pin8 – To send the request of data transmission

CTS – Pin7 – To clear the send request

RI – Pin4 – Ring indicator

DSR – Pin6 – To indicate that data set ready

DCD – Pin5 – To indicate data carry detect

DTR – Pin3 – To indicate data terminal ready

Debug Interface

Debugging helps the developers to debug the module and update its firmware. In this module,there are sperate serial interface pins for debugging. Both pins are:

DBG_TXD – Pin27 – For Data Transmission

DBG_RXD – Pin28 – For Data receiving

SIM Interface

As we know that module SIM900A is a GPRS/GSM module. The module is dependent on some devices for some of its features. The most important one is the SIM. The SIM needs to connect with the module for GPRS/GSM functions to fully operate. All the sim interface of the

module is:

SIM_VDD – Pin30 – Power Supply of the SIM

SIM_DATA – Pin31 – For data output

SIM_CLK – Pin32 – For clock pulse

SIM_RST – Pin33 – For reset

SIM_PRESENCE – Pin34 – To detect the SIM

Figure 3.1.1 GSM SIM 900A

How to use SIM900A GSM Module?

The module SIM900A has multiple pins but all of them have some hardware requirement that is available in the datasheet. There is a bunch of predesigned board which solves the requirement ofthe hardware. To use the module connect it with the Arduino like the given circuit.

After connecting the device use the AT commands through Arduino COM port or by Arduino Programming to operate the module each function. In case of sending data through Serial Programhere's the example code for simple AT command.

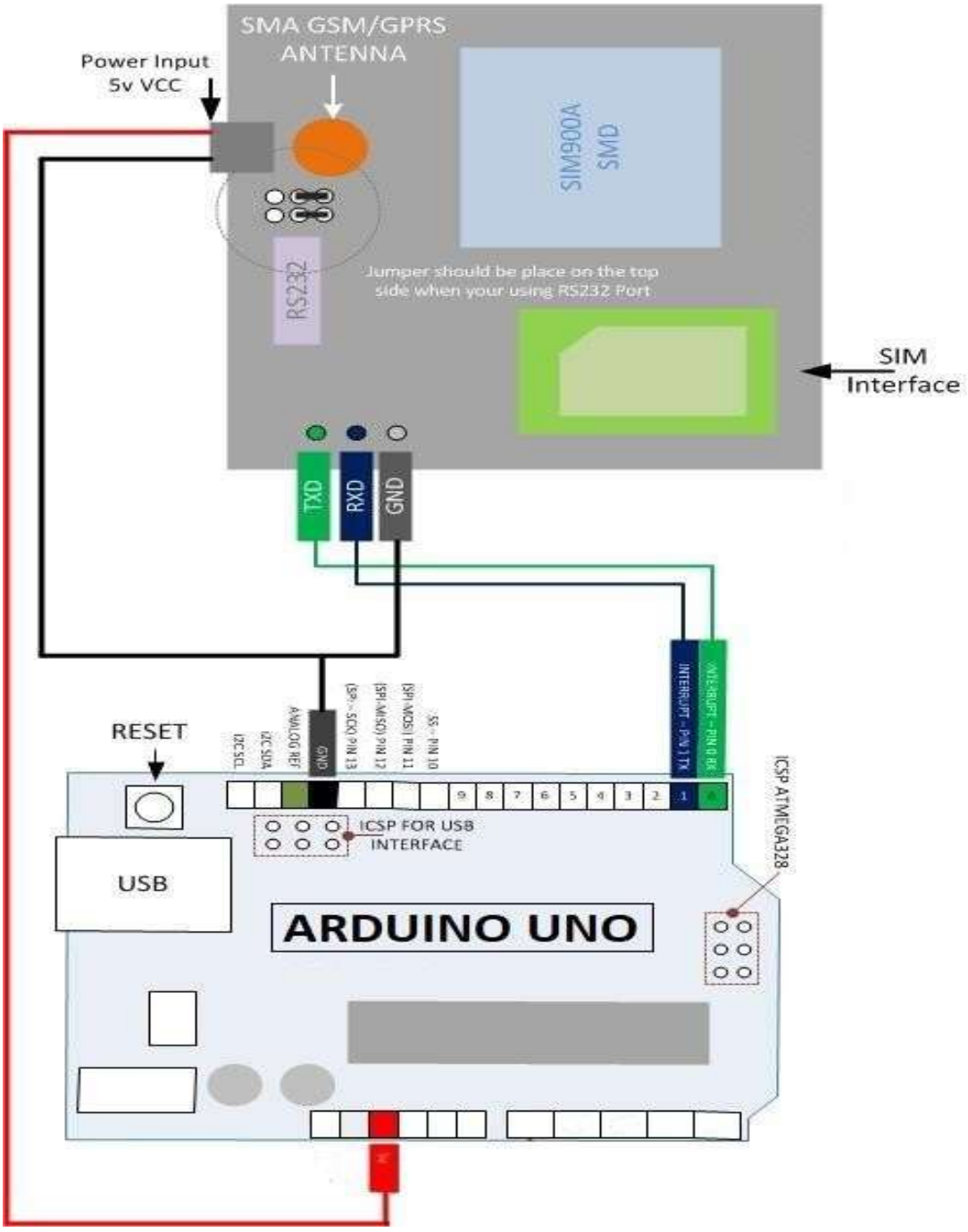

Figure 3.1.2 CONNECTION WITH ARDUINO

3.1.2 ARDUINO UNO

The Arduino UNO is a standard board of Arduino. Here UNO means 'one' in Italian. It was namedas UNO to label the first release of Arduino Software. It was also the first USB board released byArduino. It is considered as the powerful board used in various projects. Arduino.cc developed the Arduino UNO board. Arduino UNO is based on an ATmega328P microcontroller. It is easy to use compared to other boards, such as the Arduino Mega board, etc. The board consists of digital and analog Input/Outputpins (I/O), shields, and other circuits. The Arduino UNO includes 6 analog pin inputs, 14 digital pins, a USB connector, a power jack, and an ICSP (In-Circuit Serial Programming) header. It is programmed based on IDE, which stands for Integrated Development Environment. It can run on both online and offline platforms. The Arduino Uno is a microcontroller board based on the ATmega328. It has 20 digital input/output pins (of which 6 can be used as PWM outputs and 6 can be used as analog inputs), a 16 MHz resonator, a USB connection, a power jack, an in-circuit system programming (ICSP) header, and a reset button. It contains everything needed to support the microcontroller; simply connect it to a computer with a USB cable or power it with a AC-to-DC adapter or battery to get started. The Uno differs from all preceding boards in that it does not use the FTDI USB-to-serial driver chip. Instead, it features an ATmega16U2 programmed as a USB-to-serial converter. This auxiliary microcontroller has its own USB bootloader, which allows advanced users to reprogramit.

The Arduino has a large support community and an extensive set of support libraries and hardware add-on “shields” (e.g. you can easily make your Arduino wireless with our Wixel shield), making it a great introductory platform for embedded electronics. Note that we also offer a **Spark Fun Inventor’s Kit**, which includes an Arduino Uno along with an assortment of components (e.g. breadboard, sensors, jumper wires, and LEDs) that make it possible to create a number of funintroductory projects.

This is the 3rd revision of the Uno (R3), which has a number of changes:

The USB controller chip changed from ATmega8U2 (8K flash) to ATmega16U2 (16K flash). This does not increase the flash or RAM available to sketches.

Three new pins were added, all of which are duplicates of previous pins. The I2C pins (A4,A5) have been also been brought out on the side of the board near AREF. There is a IOREFpin next to the reset pin, which is a duplicate of the 5V pin.

The reset button is now next to the USB connector, making it more accessible when a shieldis used.

Each component in detail.

- **ATmega328 Microcontroller**- It is a single chip Microcontroller of the ATmel family.
- The processor code inside it is of 8-bit. It combines **Memory (SRAM, EEPROM, and Flash), Analog to Digital Converter, SPI serial ports, I/O lines, registers, timer, external and internal interrupts, and oscillator.**
- **ICSP pin** - The In-Circuit Serial Programming pin allows the user to program using the firmware of the Arduino board.
- **Power LED Indicator**- The ON status of LED shows the power is activated. When thepower is OFF, the LED will not light up.
- **Digital I/O pins**- The digital pins have the value HIGH or LOW. The pins numbered fromD0 to D13 are digital pins.
- **TX and RX LED's**- The successful flow of data is represented by the lighting of theseLED's.
- **AREF-** The Analog Reference (AREF) pin is used to feed a reference voltage to theArduino UNO board from the external power supply.
- **Reset button**- It is used to add a Reset button to the connection.

- **USB**- It allows the board to connect to the computer. It is essential for the programming ofthe Arduino UNO board.
- **Crystal Oscillator**- The Crystal oscillator has a frequency of 16MHz, which makes theArduino UNO a powerful board.
- **Voltage Regulator**- The voltage regulator converts the input voltage to 5V.
- **GND**- Ground pins. The ground pin acts as a pin with zero voltage.
- **Vin**- It is the input voltage.
- **Analog Pins**- The pins numbered from A0 to A5 are analog pins. The function of Analogpins is to read the analog sensor used in the connection. It can also act as GPIO (General Purpose Input Output) pins.

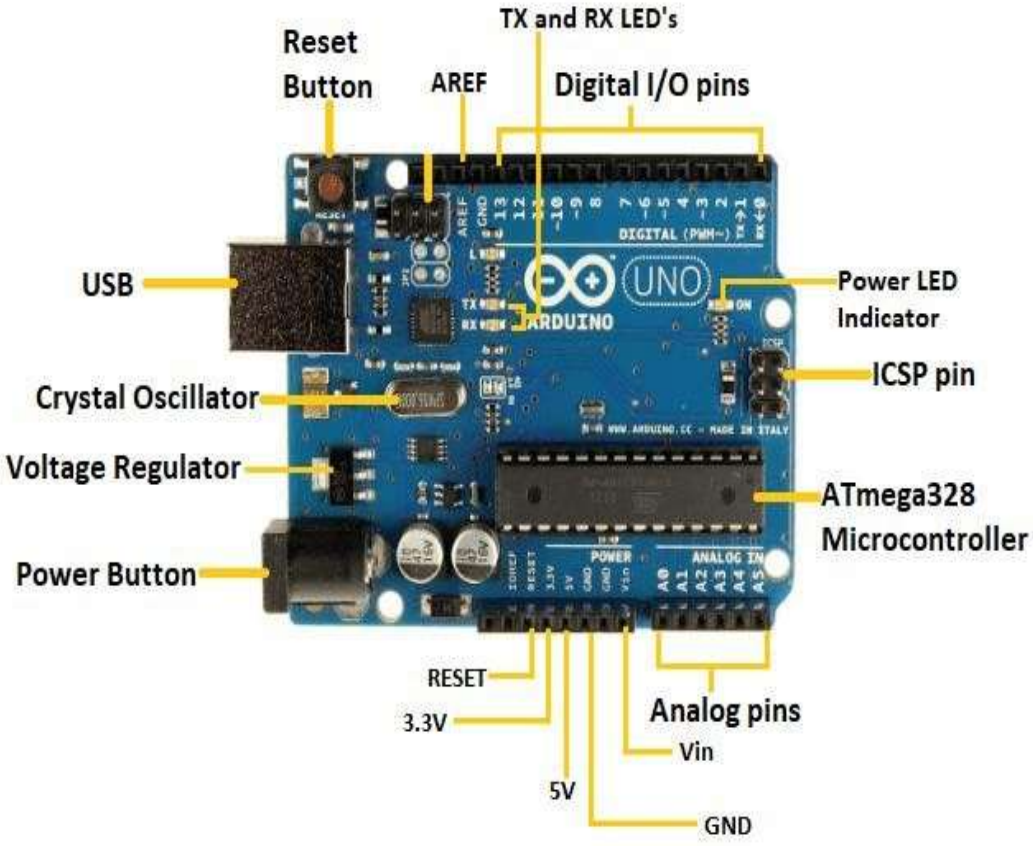

FIGURE 3.1.3 ARDUINO UNO

3.3 ARDUINO IDE

The Arduino IDE is an open-source software, which is used to write and upload code to the Arduino boards. The IDE application is suitable for different operating systems such as Windows,Mac OS X, and Linux. It supports the programming languages C and C++. Here, IDE standsfor Integrated Development Environment. The program or code written in the Arduino IDE is often called as sketching. We need to connectthe Genuine and Arduino board with the IDE to upload the sketch written in the Arduino IDE software. The sketch is saved with the extension '.ino.'

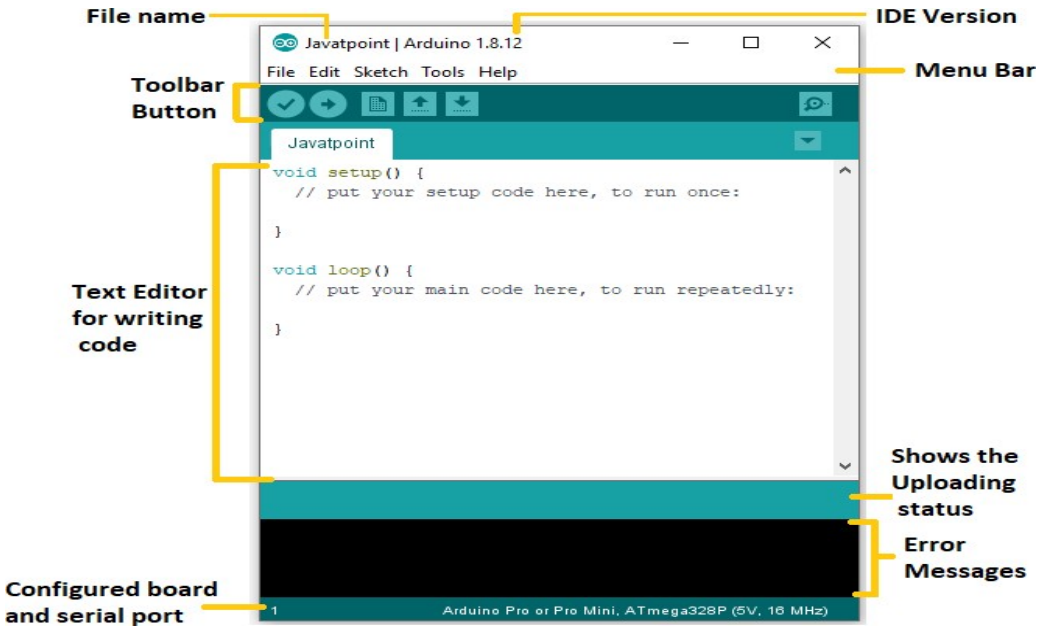

FIGURE 3.1.4 ARDUINO IDE

3.4 ESP32 CAM MODULE

The ESP32-CAM is a small size, low power consumption camera module based on ESP32. Itcomes with an OV2640 camera and provides onboard TF card slot. The ESP32-CAM can be widely used in intelligent IoT applications such as wireless videomonitoring, Wi-Fi image upload, QR identification, and so on. The ESP32-CAM suit for IOT applications such as:

- Smart home devices image upload

- Wireless monitoring
- Intelligent agriculture
- QR wireless identification
- facial recognition

FAETURES

- 802.11b/g/n Wi-Fi.
- Bluetooth 4.2 with BLE.
- UART, SPI, I2C and PWM interfaces.
- Clock speed up to 160 MHz.
- Computing power up to 600 DMIPS.
- 520 KB SRAM plus 4 MB PSRAM.
- Supports WiFi Image Upload.
- Multiple Sleep modes.

SPECIFICATIONS

WIFI module: ESP-32S

Processor: ESP32-D0WD

Built-in Flash: 32Mbit

RAM: Internal 512KB + External 4M PSRAM

Antenna: Onboard PCB antenna

Wi-Fi protocol: IEEE 802.11 b/g/n/e/i

Bluetooth: Bluetooth 4.2 BR/EDR and BLE

WIFI mode: Station / Soft AP / Soft AP + Station

Security: WPA/WPA2/WPA2-Enterprise/WPS

Output image format: JPEG (OV2640 support only), BMP, GRAYSCALE

Supported TF card: up to 4G

Peripheral interface: UART/SPI/I2C/PWM

IO port: 9

UART baud rate: default 115200bps

Power supply: 5V

Transmitting power:

- 802.11b: 17 ±2dBm(@11Mbps)
- 802.11g: 14 ±2dBm(@54Mbps)
- 802.11n: 13 ±2dBm (@HT20, MCS7)

Receiving sensitivity:

CCK,1Mbps: -90 dBm

CCK,11Mbps: -85 dBm

6Mbps (1/2 BPSK): -88 dBm

54Mbps (3/4 64-QAM): -70 dBm

HT20, MCS7(65Mbps, 72.2Mbps): -67 dBm

Power consumption:

Flash off: 180mA@5V

Flash on and brightness max: 310mA@5V

Deep-Sleep: as low as 6mA@5V

Modern-Sleep: as low as 20mA@5V

Light-Sleep: as low as 6.7mA@5V

Operating temperature: -20 ℃ ~ 85 ℃

Storage environment: -40 ℃ ~ 90 ℃, <90%RH

Dimensions: 40.5mm x 27mm x 4.5mm

FIGURE 3.1.5 ESP 32 CAM MODULE

3.2 ANY SUPPORTING TOOLS USED

3.2.1 FTDI PROGRAMMER

The FTDI Smart Basic hardware is pretty simple. It routes the serial signals from an Arduino Pro, Pro Mini, Fios, or Lilypad board (along with any other board which uses the standard FTDI header footprint) either to the programming PC via a USB-to-serial bridge or to any other device with the FTDI Basic-type header.

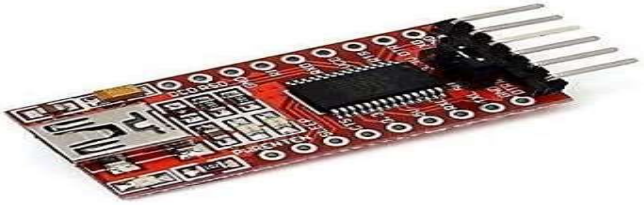

FIGURE 3.2.1 FTDI PROGRAMMER

3.2.2 JUMPER WIRE

A jump wire (also known as jumper, jumper wire, jumper cable, DuPont wire or cable) is an electrical wire, or group of them in a cable, with a connector or pin at each end (or sometimes without them – simply "tinned"), which is normally used to interconnect the components ofa breadboard or other prototype.

FIGURE 3.2.2 JUMPER WIRE

3.2.3 BREADBOARD

A breadboard is a solderless device for temporary prototype with electronics and test circuit designs. Most electronic components in electronic circuits can be interconnected by inserting their leads or terminals into the holes and then making connections through wires where appropriate. The breadboard has strips of metal underneath the board and connect the holes on the top of the board. The metal strips are laid out as shown below. Note that the top and bottom rows of holes are connected horizontally and split in the middle while the remaining holes are connected vertically.

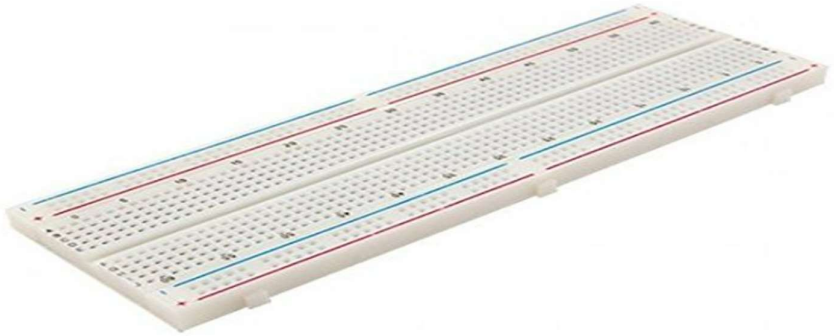

FIGURE 3.2.3 BREADBOARD

3.2.4 USB cable

This cable features a standard Type-A USB connector on one end and a standard Type-B connector on the other. For example, you can plug the Type-A connector into your computer then plug the Type-B connector into ESP32 with a Type-B port. Printers and servers often have Type-B ports.

FIGURE 3.2.4 USB CABLE

Voltage Regulator

The power supply unit of an electronic device converts incoming power into the desired type (AC-DC or DC-AC) and desired voltage/current characteristics. A voltage regulator is a component of the power supply unit that ensures a steady constant voltage supply through all operational conditions. It regulates voltage during power fluctuations and variations in loads. It can regulate AC as well as DC voltages.

FIGURE 3.2.5 VOLTAGE REGULATOR

3.3 TESTING AND VERIFICATION

There are three parts that was combined to make the system. The three parts that was combined were circuit for interfacing is ARDUINO, GSM Module and ESP32 cam. Circuit operation was in good condition with the right sequence of program that uploaded into microcontroller. For the light to voltage sensor part, Arduino with microcontroller ATmega238 was used. At the program, the number of mobile phone user was set to receive a message when limit reach. In GSM network, the network plan SIM card was used to transmit message to mobile phone. To combine this three-part system, the GSM module Tx and Rx was connected to pin 2 and 3 respectively to Arduino while RTC used analog pin A4 and A5 at Arduino for CLOCK and RS. Before the system work successfully, some problems occurred during setup and test the system.

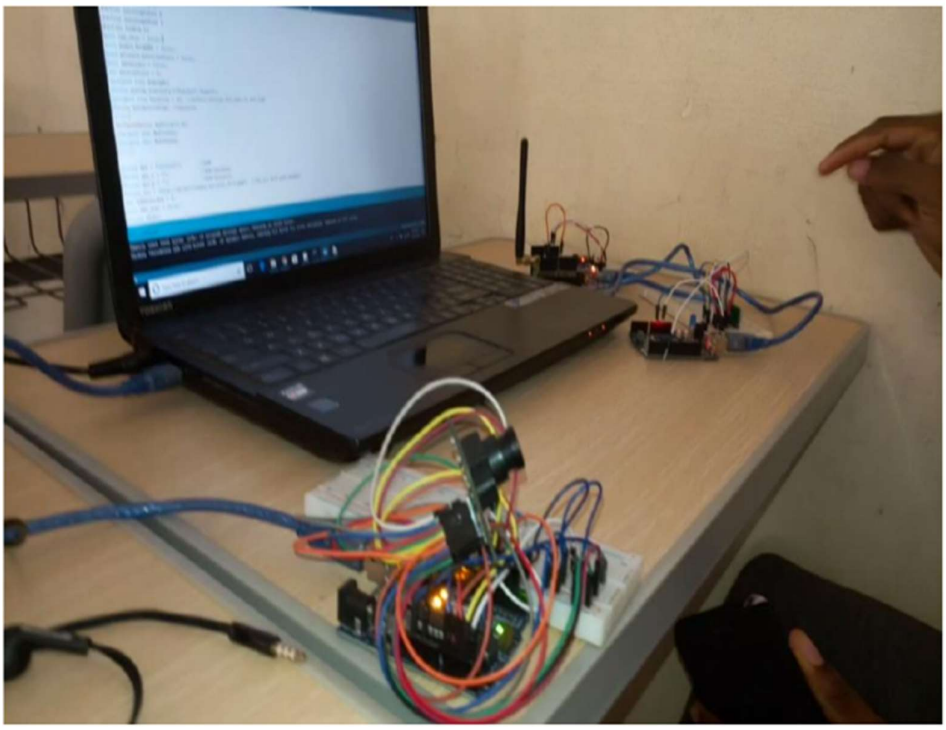

FIGURE 3.3.1 TEST SETUP OF PROTOTYPE

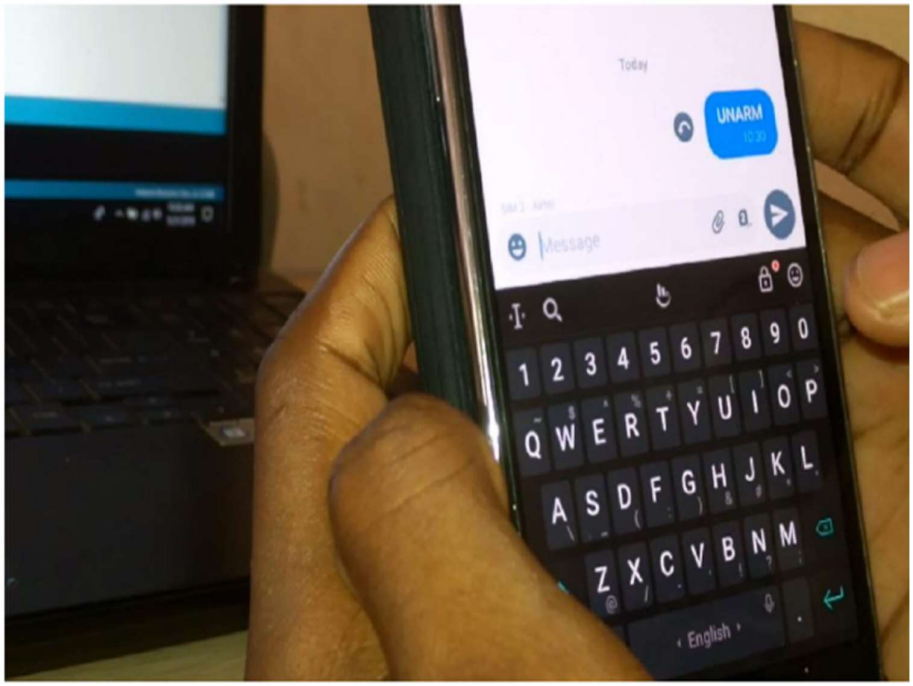

FIGURE 3.3.2 ALERT SYSTEM VIA MESSAGE

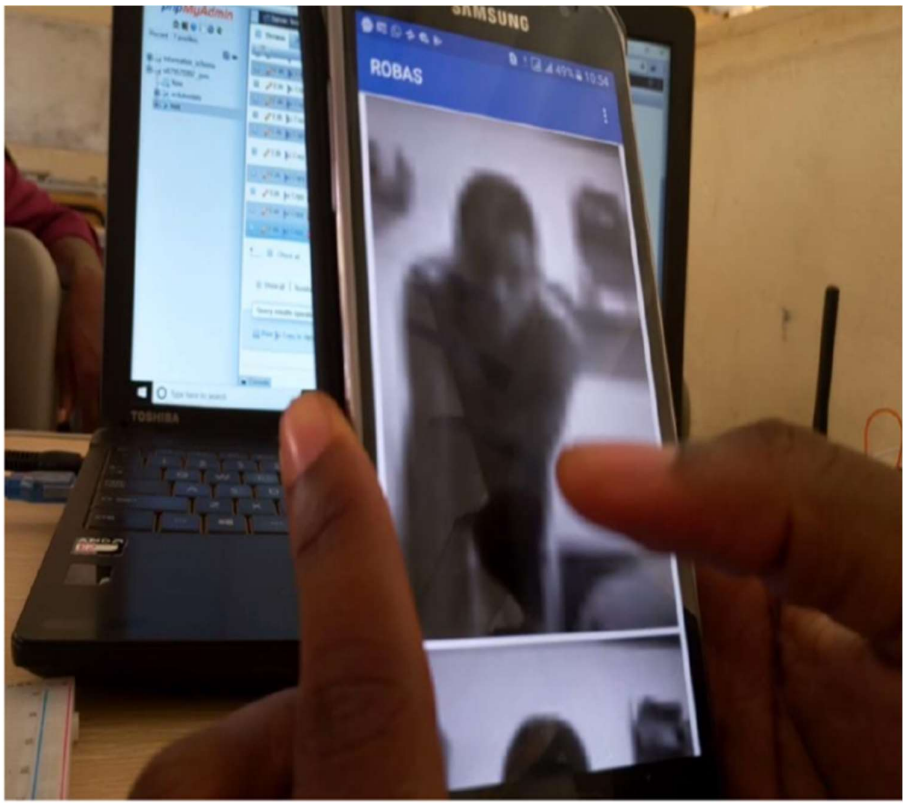

FIGURE 3.3.3 PICTURE TAKEN BY ESP 32 CAM

CHAPTER 4
CONCLUSION AND FUTURE SCOPE

CONCLUSION

Almost all schools and academic institutions along with parents require presence record of students andmaintaining manually can be hectic as well as time consuming task. Hence maintaining presence automatically with the help of scanner and GSM will be very helpful and less prone to errors as comparedto manual process. This will also reduce manipulation of presence record done by students and it will save time as well. This system aims to build an effective presence alert system using QR code, cam scanner and GSMModule techniques. The proposed system will be able to inform the ward parent via SMS and Email. After the receiving message and email parent will be sure about their kid's safety.

FUTURE SCOPE

The future scope of the proposed work can be using face recognition, capturing multiple detailed images of the kids and students and using any cloud technology to store these images. The system can be configured and used in Atm machines to detect frauds. Also, the system can be usedat the time of elections where the voter can be identified by recognizing the face. In future developments of this work, other technologies such as fire detection structures (smoke detectors, temperature sensors, etc.) and other safety systems could be integrated into the current design to achieve a more holistic room security system. Additionally, the robustness and reliability of the detection, data processing, and reporting functionaries should also be improved algorithmically and physically for better system performance and minimization of cases of false alerts, system security breaches and physical breakdowns. Finally, the inclusion of local security as targets for security alerts should be considered. However, as suggested, the accuracy and dependability of the system's performance is very crucial for acceptance for use by these security agencies.

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