Automatic Ringing Door Bell: Review and Fabrication

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Abstract - This study focused to compile earlier works dedicated on the development of automatic ringing door bell that have low cost and efficient life spam. Now a day's the augmentation of such systems,among our societyis high due to protection form virus like COVID-19. The contamination of surface through infected person leads to spread of virus. So, numerous of automatic systems are develop in order to protect the object from physical contact like automatic lightening systems, ringing bells, automatic closing and opening of doors, touch less water draining systems, touch free ceiling fans and many more. Among said systems, automatic ringing door bell have huge demand in every house hold due to awareness and prevention form spreading of virus. The automatic door bell beneficial to get information about the person arrived at home and without pressing the switch it will ring. The systems are based on image processing technique, machine learning approach or Internet of things for efficient functioning. Hence, in this review article, a numerous of articles are reviewed to give a conclusive remarks towards fabrication of cheap and efficient automatic ringing door bell. After discloser of efficient system gathered from earlier research work, an attempt has been made to develop a prototype of automatic ringing systems. Study reveals that the waves signals based sensor that automatically rings the bell is efficient one. Furthermore, the systems requires a PIR sensor to detect the waves signals of a person which is further transfer to activate the ESP32 cam for capturing the photo, consequently ring the buzzer. If the person is detected, the door bell is automatically turned ON and rings the bell.

Keywords - Automatic Ringing Bell, PIR Sensor, ESP32, Blynk App.

I. INTRODUCTION

In 21st century the Pandemic like COVID-19 creates huge opportunity for atomization in day to day life activities,to protect himself from spread of virus. Earlier studies dedicated on the spreading of virus observed that the infected people transmit the virus through physical contact or by touching the surfaces or objects where virus can persist for prolong time. The contaminated surfaces or objects when come in exposure with normal people it infected him with virus.To mitigate the problems of contamination from surface or objects various type of automatic products are available in the market like automatic lightening systems, ringing bells, automatic closing and opening of doors,touch less water draining systems, touch free ceiling fans and many more that didn't required any physical contact [1-4].Hence, to control the spread of virus automated devices should be available at affordable price and prolong life.

Among various automated systems ringing bells are most important device that used in every household for safety as well as information of visitor at our house. The earlier ringing bells are cheaper but require physical contact for pressing consequences in the spreading of virus. To mitigate the said problem various types of automatic ringing bell are preferred in every house that didn't require any physical contact. Furthermore, these devices automatically recognise the face of arrival person and provide the information to house owner.

The concept of automatic door bell is not started after COVID-19 pandemic arrival but it isavailable probably from 2013. As, per Wikipedia Jamie Siminoff is the first entrepreneur who develop ringing video doorbell fully automated function [5]. Later, numerous of devices have been introduced in the market, which are fully automated functionhavingnumerous of unique feature [6-8]. But, the costs of such device are not affordable by the people living in low income countries. Furthermore, the systems that are available in commercial market have complicated configuration which can't be easily replaced and need an expert to repair the system. The maintenance cost of such systems is very expensive that restrain the user for comfortably used. Earlier systems also defer in user friendly environment that need a proper training for the end application. The power providing arrangements are also need to enhance as the earlier systems are not functioning during power loss. So, the automatic techniques didn't require much power during functioning that

can be operated during power loss. The earlier systems are also having disadvantages of reaching the switches to press for operation. The automated systems directly take the information about the visitor and send information to the honour of house. The earlier systems are also lacking in the safety and security due to easy provision to tack and beak the functioning system. To encompass such aforementioned problems engineers and scientists put endeavour to develop an automatic door bell system, operated automatic, user friendly, easily maintenance can possible as well as increases the safety and security to high extent. To fabricate such systems a though understanding as well as knowledge is indeed requirement. Hence, in this study a conclusive study on affordable automatic ring bell is carried out. Hence, in this study a conclusive study on affordable automatic ring bell is carried out. Therefore, the objective of this work is to compile and review numerous of earlier works that are dedicated towards development of automatic ringing as well as opening of door. This work also provides an insight view of algorithm that is handy enough to operate with any system alongside cheaper in cost. So, at last, based on the review work an attempt has been made to develop an automatic system that automatically ring the bell and provide information about the visitor. Finally, a conclusiveremark on the development and feasibility of such device,based on market demand as well as software compatibility is postulated.

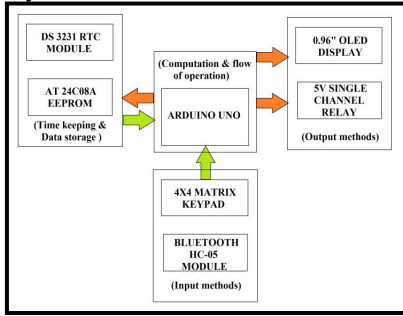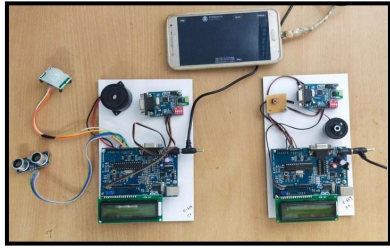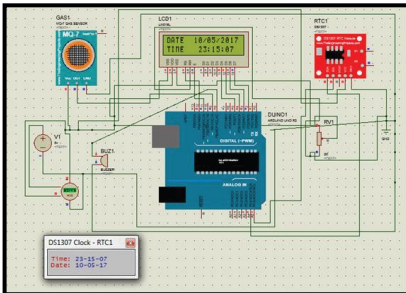## II.   LITERATURE REVIEW ON DEVELOPMENT OF AUTOMATIC RINGING DOOR BELL

In order to develop cheaper automatic ringing bell numerous of researchers used camera and Yolo algorithm that provide ample function at minimum coast. In this regard, Aldawira et al. [9] developed door security system using camera and Yolo algorithm, powered by solar system attached with a battery. Researchers developed a QR code using Blynk application for sharing the information that allows him for access. Researchers also showed that the cost of device is much cheaper than other market available automatic door bell. Later, Lokesh et al. [10]developed a contactless doorbell especially for COVID-19 infected person that check the body temperature and responds accordingly. The device used Internet of Things based on Blynk Software that allows users to view the scanned temperature alongside the camera facility provides information about the person in the app.

The device has option for opening or closing the door based on the temperature of the body. Finally,researchers showed that the developed device was compatible with NodeMCU, Arduino, and other microcontrollers that successfully functioning.Prathapagiri and Kosalendra [11]developed Wi-Fi door lock using Blynk software base on Internet of Thing (IoT) algorithm assisted with ESP32 CAM. Researchers demonstrated that an alarm was blink when anyone arrives at the home along with its picture. After verifying the person owner can open the door using mobile device. Researchers recommended to add temperature sensors that further improve its competence in market. Later, a similar device was made by Aparna et al. [12] based on Wi-Fi technique accompanied by IoT using Blynk software assisted with ESP32 CAM. Researchers successfully demonstratedthe application of device towards achievement of high security at home. Sharma et al. [9] analyzed several researches to illustrate the feasibility of IoT system integrated with cloud server towards development of high security door bell.

Researchers demonstrated that the IoT integrated with the variety of input/output systems, sensors, and actuators towards collection of the data without any human intervention which further utilized to serve as high security through global internet.Aldawira et al. [13] developed a system for Android using Internet of Things (IoT) technology to continuous monitor the status of door i.e. close or not. Researchers used a technique known as MQTT cloud to make conversation between smartphone and door lock system. For detection of human movement a PIR sensor was attached on the door along with a touch sensor at the handle of door to recognise the hand of any human. If force applied on the door for opening of the door an alert or alarm starts ringing and inform the owner. Furthermore, researchers showed through simulation that when the sensor placed at a height of 48.5cm, device accurately receive a warning message on smartphone forthe movement of human takes place upto1.6 meters from the door beyond 1.6 m less accuracy was observed. Raju et al.[14] developed a digital door locksystem based on Wi-Fi technology using Internet of Things (IoT) concept. The developed systems consist of ESP32 CAM wired wire app alongside PIR motion sensor. The visitors face was identified with help of ESP32 CAM, whereas movement or motion of individual was detected by PIR motion sensor. After detection of face and motion, the telegram send message to the owner,for his approval to open the door or not. After successful demonstration of device researchers suggested that the living body detection or spying may be possible using same system, by replacing ESP32 CAM with Raspberry Pi Infrared camera.

Gomathy et al. [15] made an endeavour towards development of facial recognition system by installing a display monitor unit connected with HD camera at the door. The device consisted of Raspberry Pi ARM processor that provide voice locking facility for further converting it into text message received by the owner of house. Gamboa et al. [16] used MQTT cloud protocol technique to develop an smart door lock systems. If the owner forget to close the door, this device facilitate him to close the door from anywhere using his smart cell based on Internet of Things concept. Major components used by the researchers in order to developed smart door bell were Electric Strike Door Lock, PIR Sensor, Two Mosfet, Alarm Buzzer, Internal Touch Sensor, Step Down Adaptor 12V to 5V, PCB Board, LED (Green, Red), and Magnetic Sensor. A systematic analysis for better understanding towards development of automatic ringing bell is complied in **Table 1.**

Table 1. Software Used to Develop the Automatic Ringing Bell.

Controller used	Devices used	Methodology/ Summary of work
ESP32 and DS3231 R.Z. Mahmood [17]	Wi-Fi	Automatic synchronized bell system connected through Wi-Fi technology that adjust the $\pm$ 40 seconds per year in absence of internet, was successfully demonstrated. The timetable was configured using ESP32 followed by SSID to send the signal and PASS the router.
Arduino Uno, ATMega328p DS3231RTC module Aishnavi et al. [18]	HC-05 Bluetooth, wireless communication	Developed device successfully showed multiple time table setting features alongside multiple event controller. Block diagram the system is shown below:
Ultrasonic and PIR sensor Kumar et al. [19]	Arduino interface LCD, ZigBee transceiver signal	The device used ultrasonic and PIR sensor to detect the movement send the signal to ZigBee in turn it vibrate the motor that vibration signal further used as alert. The device is shown below.
ARDUINO MEGA Real-time clock (RTC), Poobalan et al. [20]	Smoke sensor, Buzzer and LCDs	A solar powered energy efficient device was successfully made to ring the bell as well as fire detection. The complete circuit of the device is shown below:
IoT, Arduino Uno, transmitter, cloud, receiver, Nalini et al [21]	RTC module, LCD module, Relay and bell.	An automatic ringing bell is developed for examination purpose in which RF module and LCD are synchronies for display the notices. THE block diagram of device is shown below:

Ultrasonic sensor and Arduino uno [9]	IDE (Integrated Development Environment) through USB Type B cable, 9-volt battery	Developed a touch less doorbell efficiently work in doctors cabin or at houses. The hardware connection is shown in below diagram:
Bluetooth module Arduino board, Smartphone App [20]	Ultrasonic and moisture sensor.	Developed low cost and user friendly automatic ringing bell for home to identify the visitor. The device was remote controlled and operated using Smartphone App.

III. FABRICATION OF AUTOMATIC DOOR BELL

After analysis from above literature review it can be observed that the fabrication of cheaper automatic door bell is possible. Hence, an effort has been made to develop a cheap automatic door based on Blynk App. The hardware components used to fabricate the automatic door bell are ESP32 Microcontroller, PIR Sensor, FTDI Programmer, Camera Module and Blynk App. The said hardwares are easily available and efficient in performance. The development of automating ring door bell consists of several steps. In first step, the ESP32 microcontroller is programmed using the Arduino IDE. The PIR sensor is connected to one of the GPIO pins of the ESP32, and the FTDI programmer is used to upload the code to the microcontroller. Alongside, the camera module is connected to the ESP32 via its I2C interface. The captured image is saved to a micro-SD card. At last, the Blynk app is used to receive notifications from the ESP32 microcontroller and view the captured photo. The user must first create an account in the Blynk app and create a new project. Then, the user must obtain the authorization token from the app and enter it in the code. Once the code is uploaded, the microcontroller will continuously monitor the PIR sensor for any movement. When movement is detected, the camera module captures an image of the visitor. The ESP32 then rings the bell and sends a notification to the Blynk app, notifying the user that someone is at the door. The Blynk app allows the user to view the captured photo. The systematic piscatorial flow diagram that shows all components of automatic door bell is shown in **Fig 1**.
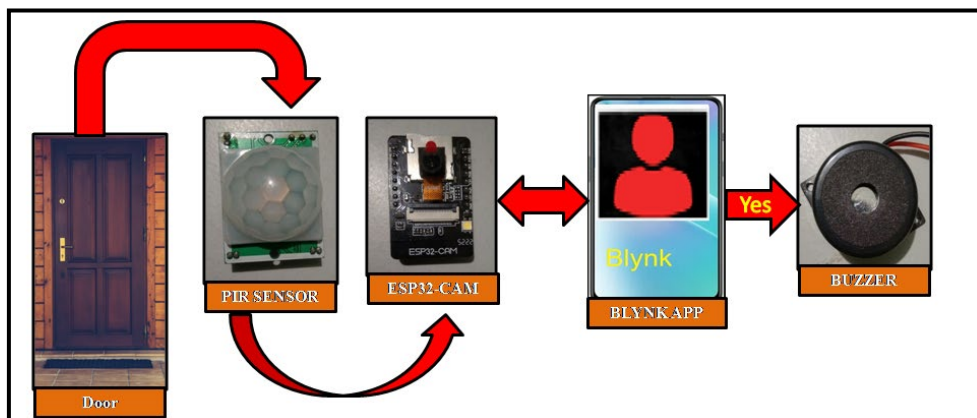

Fig 1. Systematic representation of Automatic Door bell.

After fabrication the prototype was installed on the door of the house for its performance evaluation. The performance of device was satisfactory with meeting the objective of work. The sensing and synchronizing the information was successfully carried out by the automated device butrequire some more improvement that prompted its commercial application. But before application some changes are required in order to develop a very efficient product. After performance evaluation, the range to detect the movement of an object needed to increase as it only recognize the distance limited to 2 m.Furthermore, the system need strong configuration to control and store the data. However, the device is very user friendly and easy to operate alongside easy to maintenance.

IV. FUTURE PERSPECTIVE OF THIS WORK

The advance systems are now aligned with IoT based systems that rapidly capturing the commercial market by replacing the conventional product, which is also acknowledge by the manufacturers as well as customers. Furthermore, the IoT based systems not only contributed in the economic growth of nation but also yield substantial opportunities for the future growth in various fields. Based on the IoT technology the current advance devices are successfully implemented for safety and monitoring purpose. The above complied work also demonstrates the same. A lot of research also demonstrated successful application of IoT based system towards monitor, safety and high level of security of house, malls, hospitals, memorial places. Furthermore, such system can be also applicable for the monitoring the outside objects from the remote place. The systems are high reliable and indeed requirement for future generation with higher standard of living.

V. CONCLUSION

An in-depth review on the development of automatic ringing bell is carried out that suggests the low cost and efficient door bell could be achieved using simple components like ESP32, PIR, FTDI, and Blynk Notification. Various researchers integrated the automatic ringing bell system with higher safety devices, like smoke sensor, temperature sensor, moisture sensor in order to make it highly adaptable for houses and schools. After analysis in this work an endeavour has been made to developed automatic ringing bell with face recognise system that alert the owner for stranger visitors. Hence, with the help of the ESP32 microcontroller, PIR sensor, camera module, with Blynk app, a low cost customized device is implemented to fit in any home or business environment. The device efficiently detects the person from a distance of 6 m and send alert to Smartphone with help of Blynk app.

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