AI Based Locking and Unlocking of Door Based on Eye-Ball movement, Knocking pattern and Facial Recognition

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Abstract: *Being surrounded by ever-growing smart applications, technology is revolutionizing the world. Smart devices can be pivotal in possession of elderly and disabled people with adequate access. With the constant progress in the Technological world, concerns for safety also increase day by day. Protection like keys can be replicated quite easily. So, here is a smart security system with the use of 'Artificial Intelligence Markup Language'. Here , the security system is based on a 'Eye ball motion pattern'' knock-pattern' 'facial recognition' The task of face recognition has been actively researched in recent years. Face recognition is an important research problem spanning numerous fields and disciplines.*

Keywords: Piezo sensor, Raspberry pi, AIML, Eye-ball motion, python, ID based entry, Multi security

I. INTRODUCTION

The Multi-security AIML based entry-way Locking/Unlocking system is a smart embeddedsystem based entry-way locking/unlocking system which uses various security approaches to lock/unlock a door/entry-way. It uses various input devices to capture information/input from person. The input data could be a frame captured via camera device, voice of person, or any arbitrary pattern input. The system can Lock/Unlock door with various approaches like Eye-ball movement pattern based, door knock pattern based, and person's voice ID based entryway/door locking/unlocking. To achieve Eye-ball movement pattern-based security approach it uses advance AIML based algorithm (written in python) which uses various advance APIs/Libraries. The camera device is mainly used for this approach. For person's voice identification an algorithm/code is implemented (written in python) which uses various Digital Signal Processing (DSP) and AIML based APIs/Libraries. This algorithm takes voice input via microphone device and sound card which is then pre- processed for further processing. These algorithms/python-scripts/code are running in laptop or desktop device to which the media devices are interfaced (Camera & Sound Card). The system also consists of MCS51 microcontroller (AT89C51) based hardware which control's various I/O devices and used to recognize knock-pattern. This microcontroller based system continuously communicates with the python- scripts/codes running in laptop/desktop via USB-to-TTL interface and serial communication APIs/library. This hardware is also responsible to control the electro-magnetic solenoid lock which helps to Lock/Unlock door without any human- interaction. For indication purpose few multi-colour LEDs are used which indicates various statuses such as heart-beat of the system (indicates system is running or hanged), lock/unlock status, etc. For system configuration and control few switches are used. The knock pattern recognition is also implemented on the same microcontroller which takes input from piezo-electric plate and checks for the knock pattern. The microcontroller is programmed using embedded-c programming language using Keilu Vision python programming language is used with various libraries/APIs (such as PyTorch, OpenCV, numpy, etc.).

II. LITERATURE SURVEY

Nishad N. Gupta & Mihir R. Shelar [1]proposed a smart door locking system, A smart phone is now a very common device that everyone carries with them all the time. Smart phones have enabled us to perform various tasks while using

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a single device. Considering this phenomenon they had exploit the idea of remote-controlling a door with the help of a smart phone. Physical keys and a lock were the basic requirements for a door. However managing these keys had become cumbersome. To overcome this, they presented a solution which is a smart and a secure way of remote-controlling the door using a smart phone. using physical keys to lock or unlock the door is the most natural way and everyone is acquinted with it. the physical key is a well-tested and well-known technology, but it also has its flaws there can only be one unique key for a lock. for different locks you have different keys. further more, carrying a large number of keys is a burden and increases the chance of keys getting stolen, misplaced or lost. Our goal is to design a solution for secure access control that can replace physical keys for accessing door. We propose a solution using digital keys on smart phones providing wireless and automatic unlocking via Bluetooth. The design will allow easy implementation and distribution of keys and the device will work autonomously. This will enhance the security and will eliminate the need of carrying physical keys.

Dimpal Gautam, Priya Ghonge, Pranita Yerne [2] proposed a facial recognition based door locking system Security describes protection of life and property. The main purpose of this system is to provide better security by using face recognition technique. Eigen face algorithm is a basis for face recognition that provides high accuracy and moderate sensitivity to variations in the intensity of light. It is one of the fastest way to identify faces. This project works in two modes: offline and online. Firstly, the PIR sensor senses the person standing outside the door. Then camera receives instruction to capture image of person standing in front of the door. This captured image is compared to the images stored in the database. The person standing in front of the door will be granted access, if his/her image is recognized. If it's not the authorized person gets a notification via GSM. If the authorized person grants permission, only then the door will open. Or else it will remain closed for further action. This project makes use of Laptop as a processing unit. It uses MATLAB software to carry out the face recognition procedure. The system takes input image by capturing a real time image for online process. For offline process the input image is given manually.in todays's world of connectivity and smart devices there is an urgent need to modify our existing day to day objects and make them smart, also it is not the era when we can blindly trust the old and conventional security measures, specifically speaking is our door locks. To change and modernize any object we need to eliminate its existing drawbacks and extra functionality.

Aditya Naik, Jitesh Patil, Vikrant Naik [3] proposed a knocking based security system the basic idea behind this project is to provide security to people on just the knocks. The knock pattern is detected and locking and unlocking is done on that basis. It's a small idea with a vast application and hence chances of holding the future market. Being a fascinating concept the problem being complexly coding it for the proper usage. Whereas this project being a prototype, it stands up for simple coding and hence some basic features. In the code, there needs to be an interfacing done between the knocks and the door locking mechanism. Our code provides the user to knock as per their preference and hence the door unlocks. The future scope brings in complex coding where there is a pattern of knocks detected initially, saved and used on whenever the knock pattern is played on the door. It's interesting, but with an initial stage and prototype the features provided are less on the whole. In the near future, it may also include image processing for helping to provide a more secure environment. security has always been the major concern of almost every sector in the society. In the recent years, with the increase in the amount of crimes such as thiefs, robberies and event distruction and murders it has been one of the major agendas of every household and industrial discussion. hence, given this need many approaches have yielding successful results with highly secure locks.

Dr.Anita Shukla, Ankit Jain, Ritu Rajan [4] proposed a password protected home automation system with automatic door lock This paper deals with the necessity of a low cost electronic home security and automation system. By using this system we can unlock the door and operate the light, fan etc. by using predecided password. This will also help in preventing unauthorized unlocking. In case the user forgets the combination of password this system give the flexibility to the user to change or reset the password. Firstly the user combination will be compared with pre-decided password stored in the system memory. But if user combination matches with the password, the door, light and fan will be unlocked. We can lock the system also by just pressing one key. In this system Arduino UNO microcontroller board is used for interfacing the various hardware peripherals. If password is matched with pre-decided password then Arduino simply operates the relay to open the lights and fan. Arduino simultaneously operate a dc motor through motor driver for operating the door.Keywords: Arduino, Relay, Keypad, DC Motor, LCD. Nowadays most of the systems are automated in order to face new challenges and present day requirements to achieve good results. Automated systems

have less manual operations, so that the flexibility, reliabilities are high and accurate. Hence every field prefers automated control systems, especially in the field of electronics. The goal of the project is to develop a unique system through Arduino microcontroller which can control various units of the houses, industries, and also provides a security system. Just by entering password through keypad the user can perform ON/ OFF operations on the appliances.

Dr.T.J.nagalakshmi, Nallavan. G, Hari Prasath Sharma Sekaran [5] proposed a paper on intelligent door knocking system using IOT, In current day security is very important. Nowadays, in all places many robberies are going on. In this security issue, block is the major parameter. The trustworthy on the lock should me made improve. The lock may be for main door lock, baggage lock, shutter lock, grill door lock, interconnecting door lock etc. This project is based on arduino board and IOT. And also this can be used for main door and for locker door. This lock works based on the knocking pattern. The owners knocking pattern is stored in the register. When the knocking pattern is detected by the sensor, it passes it to the arduino board microcontroller. Based on the trustworthiness of the pattern the lock works. This framework is easy for installation. It can be implemented for commercial use also. The World has progressed significantly throughout the years and it has changed the manner in which we live, the manner in which we impart, the manner in which we learn and the manner in which we change. One of those extraordinary headways is progression in Technology. From creation of things like blades out of rocks to things like 3D printer to a super PC, Technology has made some amazing progress. Be that as it may, with the points of interest and advantages, additionally came the disservices and difficulties. One of the instances of this headway can be taken as the creation of the IPhone. IPhone was a noteworthy redesign from the customary sort of utilizing a telephone since it was ready to call and content as well as had the capacity to play music, recordings, and download applications. Despite the fact that these were the favourable circumstances, there were numerous detriments like battery channel and the decline of vis-à-vis correspondence because of dependence on the cell phone. With such headways in innovation, there's dependably a requirement for security and protection.

R.Sai Sharan Reddy, P.Vamsi Krishna , M.krishna Chaitanya, M. Neeharika, K.Prabhakara Rao [6] proposed a security system based on knocking pattern using arduino and GSM communication, With the constant progress in the technological world, concerns for safety also increase day by day. Protection like keys can be replicated quite easily. So, here is a smart security system with the use of 'Arduino' microcontroller, Piezo Electric and GSM Module. Here, the security system is based on a "secret knocking pattern" which can be installed to a 'safe' or any other similar object which needs protection. The lock unlocks only when a certain secret knocking pattern is implemented and an SMS alert is sent if anyone tries to sneak into contents by knocking differently. This concept eliminates the fear of replication as there is no physical Unlocking Object to start with. Thus, the smart 'Knock Based Security System' can be an added protection in our everyday lives. Arduino Uno board which act as a microcontroller unit. The Piezo sensor takes the knocking input and then passes it to the Arduino board where the input pattern is compared with the original Secret pattern. In case of wring pattern, the GSM sends an alert to the given Phone Number. The World has advanced greatly over the years and it has changed the way we live, the way we communicate, the way we learn and the way we change. One of those great advancements is advancement in Technology. From invention of items like knives out of rocks to items like 3D printer to a super computer, Technology has come a long way. This advancement in Technology has been exceptional in the 20th and 21st Centuries. But with the advantages and benefits, also came the disadvantages and setbacks. One of examples of this advancement can be taken as the invention of the IPhone. IPhone was a major upgrade from the conventional type of using a phone because it was not only able to call and text but also was able to play music, videos, and download apps. Though these were the advantages, there were many disadvantages like battery drain and the decrease of face to face communication due to addiction to the smartphone. With such advancements in technology, there's always a need for security and privacy.

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III. BLOCK DIAGRAM
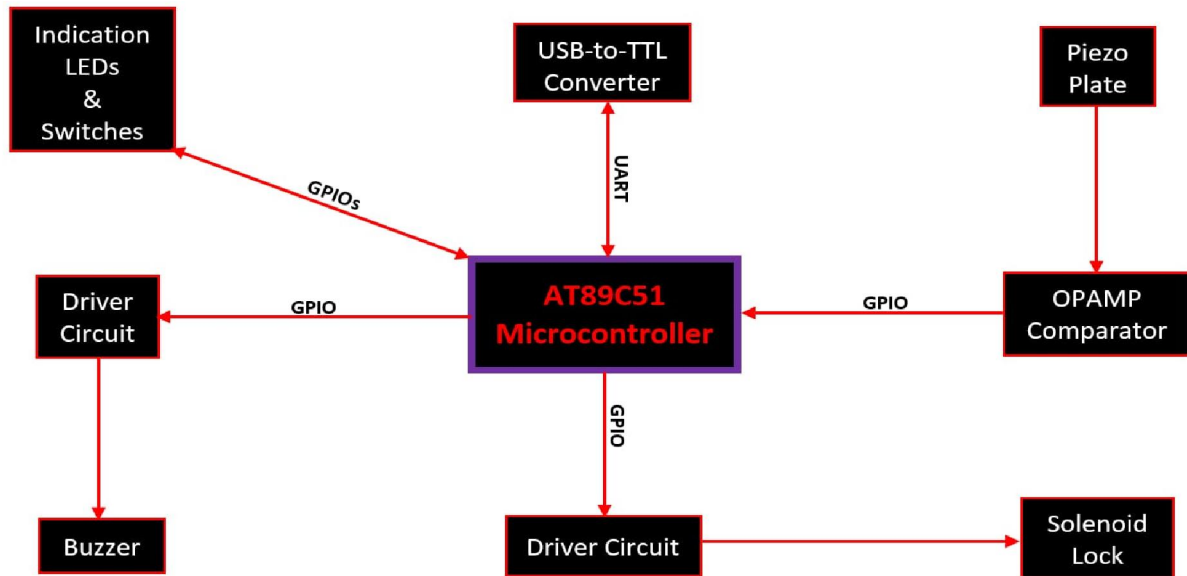
IV. COMPONENTS

RaspberryPi 3b+: The Raspberry Pi 3B+ is the latest product in the Raspberry Pi 3 range, boasting a 64-bit quad core processor running at 1.4GHz, dual-band 2.4GHz and 5GHz wireless LAN, Bluetooth 4.2/BLE, faster Ethernet, and PoE capability via a separate PoE HAT The dual-band wireless LAN comes with modular compliance certification, allowing the board to be designed into end products with significantly reduced wireless LAN compliance testing, improving both cost and time to market. The Raspberry Pi 3B+ maintains the same mechanical footprint as both the Raspberry Pi 2 Model B and the Raspberry Pi 3B.

AT89C51 Microcontroller: The AT89C51 is a low-power, high performance CMOS 8-bit microcomputer with4k bytes of flash programmable and erasable reazd only memory(PEROM). The device is manufactured using Atmel's high-density nonvolatile memory technology and is compatible with the industry standard MCS-51 instruction set and pinout.

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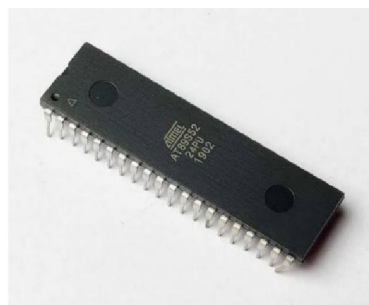
Piezo Plate: A piezoelectric plate is a device that used a piezoelectric effect to measure pressure, acceleration, strain or force by converting them to an electrical charge.

OPAMP Camparator: The OPAMP camparator compares one analogue voltage level with another analogue voltage level, or some present reference voltage, VREF and produces an output signal based on this voltage comparison.

Solenoid Lock: The solenoid lock denotes a latch for electrical locking and unlocking. It is available in unlocking in the power-on mode type, and locking and keeping in the power-on mode type, which can be used selectively for situations. The power –on unlocking type enables unlocking only while the solenoid is power on.


Driver circuit: In electronics, a driver is a circuit or component used to control another circuit or component, such as a highpower transistor, liquid crystal display(LCD) ,stepper motor, SRAM memory, and numerous others.

Buzzer: A buzzer or beeper is an audio signaling device, which may be mechanical, electromechanical, or piezoelectric.

USB to TTL converter: The AN-USB-TTL module is a cost effective way to convert TTL signal a USB interface. When connected to a PC USB port the AN-USB-TTL module is automatically detected and is installed as a native COM port which is compatible with any existing serial communication application.
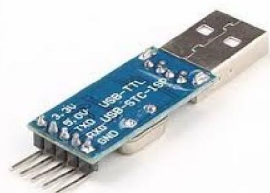
V. WORKING

The multi-security entry-way locking system consist of various security sub- systems which are dedicated to perform task based on implementation and approach used for any security aspect. As shown in block diagrams the security-system is designed with various software and hardware components/units/blocks. As shown in system block diagram it consists of various hardware blocks/units such as AT89C51 microcontroller, Driver circuits, USB-to TTL converter, Op-Amp based comparator, Piezo-electric plate/sensor, Buzzer, LEDs, Switches, etc. Each of this block/unit is used for different hardware purpose. The piezo-plate is used to detect knocks. It converts the vibrations caused by knocks on door surface into equivalent electrical impulses (analog signal) which is then feed into op-amp (LM358N) based comparator circuit. This comparator circuit reads the peaks/voltage-spikes caused by knocks/vibrations and compare that peak voltage with threshold/sensitivity value (set- point) and gives output based on comparison. The output from this comparator is then feed into one of the GPIO of microcontroller in order to recognize knock-pattern. The driver circuits are used to driver devices which requires maximum power. As microcontroller's output/sourcing power is not enough to drive devices like buzzer, solenoid-lock, etc. directly. This driver circuits are based on NPN type BJT (BC547) transistor which takes weak signal from microcontroller's GPIO and boosts it in terms of power (mostly current). The transistors are configured in CE (Common-Emitter) configuration to achieve maximum boost/gain (saturation levels) in order to switch output on/off. The electromagnetic solenoid lock is connected to one of the driver circuits along with one PN-junction diode in reverse bias. For indication purpose few LEDs are directly driven through few of the GPIOs of microcontroller.

These LEDs are used for various indications such as system heart-beat, door lock/unlock, etc. Apart from LEDs a buzzer is also used to give beep feedback/indication for more interaction. For system interaction, configuration, and control few switches are used. These switches are connected in active-high configuration to microcontroller's GPIOs. As shown in circuit diagram these various components are connected in such a way that they can interact with each other. The circuit is divided into various units as shown. The powersupply circuit consists of a 5v voltage regulator IC (LM7805) which converts the input voltage of 12v DC into regulated 5v DC. In order to minimize fluctuations in input and output power lines (i.e., 12v, & 5v) two capacitors are used (C1, C2). For power-supply indication a red-coloured LED (D1) is used. As most of the components/devices are 5v compatible so this circuit supplies a regulated 5v DC source to all of them until the input voltage is greater than equal to 7v. The indication LEDs unit consists of four LEDs as Signal, User LED1, User LED2, & User LED3. These are the indication LEDs as already mentioned. These are pulled-up to 5v via 100Ohm resistors from GPIOs of microcontroller.

These LEDs are configured as activelow configuration. The user switches block consists of three user switches which are configured as activehigh configuration. The switches are connected to three GPIOs of microcontroller while pulled-down to GND via 10KOhm resistors in order to avoid any EMF inductions and random-triggers. The buzzer- driver circuit and solenoid-driver circuit are based on BC547 NPN BJT which are used to boost the source/power in order to switch buzzer solenoid on/off. These circuits are identical the only difference is in solenoid-driver circuit a PN junction diode (D2) is used. As solenoid-lock is an electro-magnetic device it consists of coil/copperwinding which can re-induce EMF using stored magnetic flux. This re- induction can cause huge voltagespikes more than operation voltage of 5v this might cause damage to low-voltage operated devices such as BJT and microcontroller. In order to minimize/reduce this voltage-spikes a diode (D2) is connected in reverse bias with the solenoid-lock. This diode is also called as fly-back protection diode or freewheeling diode. For proper microcontroller operation and to synchronize internal units/blocks of microcontroller a crystal is used. This crystal helps microcontroller to generate a constant frequency internal clock with the help of internal crystal-oscillator circuit.

VI. FLOW CHART
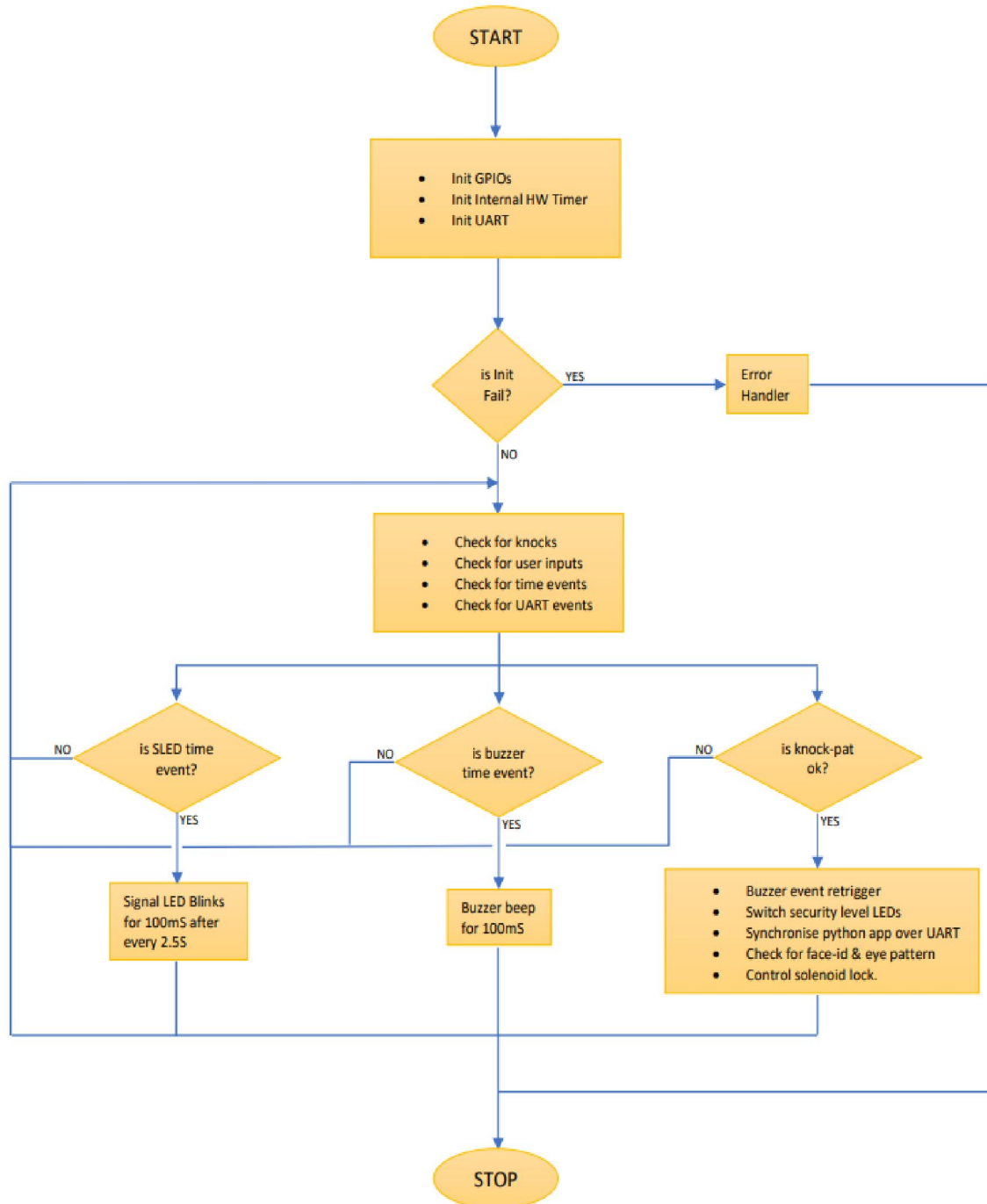
VII. APPLICATIONS

- It can be used for Multi-security purpose.
- It can be used for doors at homes, colleges and Offices,etc.
- It can be used for Industry purpose.
- It can be used for Automotive Purpose.
- It can be used for high security bank vault doors, lockers,etc.

VIII. ADVANTAGES

The advantage of this system is multi-security locking unlocking methods
- 'Face Recognition'
- 'Eye-Ball pattern'
- 'Knocking pattern'

IX. DISADVANTAGES

- Without a proper light the system is not able to recognise Face or Eye pattern.
- The current implementation is based on two different sub-systems, which can be converted into a single system.

X. FUTUTRE SCOPE

In future more work can be carried out on this system and more features can be incorporated, like we can interface GSM modem so that an automatic call can be done to the security person when any one enters wrong password. this system can be changed into double verification mechanism such as retina scanner, fingerprint scanner, OTP, PIN Code, etc. In future face recognition technique make more secure . These system are used in several places where high security required .for example banking , research institute.for smart door locking system the device can be paired using cctv module to enhance the security .

XI. CONCLUSION

In this generation of advanced technology, theft and crime has taken the aid of technology itself in achieving its results many times. To avoid such circumstances, sometimes even small things can lead to a great change. Thus, implementation of smart devices in Security Control like the Knock Based Security System can prove to be very valuable to the person using it and also to the valuables themselves. This system can be used in several places where high security is required where confidential information and equipment is kept. For example, research institutes, banks, forensic Laboratories. This system can also be used for domestic purposes. This project helps to reduce problem of thefts and frauds. In case of unauthorized person's entry, system alerts authorized person with SMS and at the same time the buzzer beeps to alert people. This is a cost efficient and reliable door locking system.

XII. IMPLEMENTATION
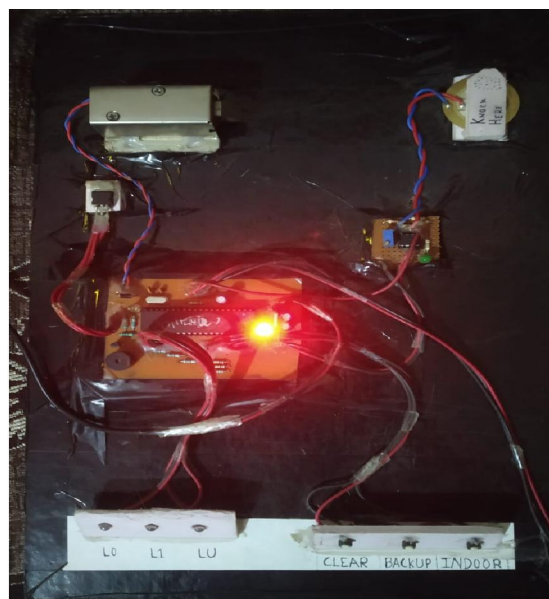
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