Microcontroller-Based Office Digitization

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Abstract The office Digitization system is an application of information technology. This system has been developed in order to minimize wasting time in a particular task. Usually, employees take long time to complete one task where it requires searching of paper, documents, and files. The main objective is to make paperless work environment where it will greatly eliminate paper usage. This will benefit employees to work efficiently, better, and quicker. This computer-based system ensures to perform functions in aspects like storing all inventory details, managing business documents in digital form, updating work order status, alerting with notification in mobile with latest notice, and many more. It stores scanned documents. Using an Arduino UNO interfaced with OV7670 camera module can capture the image of order number, convert it into text, and save it with accurate date and time. Computer processing becomes quite accurate if the task to be performed is properly prepared. So, office Digitization ensures better accuracy. Chances of error will be eliminated.

Keywords Digitization · Arduino UNO · OV7670 · Tesseract OCR

1 Introduction

The term "Office Digitization" is common since desktop computers were introduced in the business world. To optimize office environment, typewriter was initially mechanized to minimize manual task. Office Digitization is intended to simplify and improve basic office task, different activities, communication, and collaboration within multiple branches of a company or organization. It includes storing inventory details, exchanging of information, management of business documents, work

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order status, event schedules, etc. Earlier, experts were needed for typesetting, printing, and electronic recording which are integrated in this system, so that it eliminates requirements for large number of staffs.

LAN plays a major role in storing, transmitting, and receiving raw data information and helps to connect with other destination through connecting network. In our system, we have made a server. There will be two or three admin users whose name would be already stored in database. New user will have to register their details in order to enter their name in database. Registered employees have to fill the custodian details and then about their respective system details. If they face any sort of problem regarding the system, they can register any complain which will be visible to admin, so that an immediate step can be taken to solve the problem. A registered employee can only see their work order status, store and transfer documents, communicate with higher authorities, and will receive news and updates notification about any event schedules in the organization.

Office Management requires to manage business documents including images and graphics, business dates, appointments, meetings, and client information contacts which can be edited, stored, and retrieved if necessary. Business documents can be scanned and stored in a common file where all employees can use it. Using Arduino UNO microcontroller interfaced with OV7670 camera module, office order numbers will be captured and stored in the server connected with MySQL database. The image will be converted to text with the help of Tesseract OCR. In the display page of office order details, order number along with the description of the item, the date and time of delivery, and receipt will be displayed.

2 Literature Survey

Office Digitization is a broadly used term, and it represents a new profession, a new integration of technologies and a new perception of the potential of information tools available to man. It is primarily based on two factors—computers and communication technology. The computer is moving from being an independent system to a component embedded in a whole range of office devices. Communication technology integrates these devices and people. It provides an effective communications infrastructure. So, office Digitization is the use of various technologies (e.g., computer and telecommunication) to simplify and support routine office functions, improve communication, increase office productivity, and enhance the quality of clerical output.

In the recent past, we can view almost everywhere Digitization playing a crucial role. Digitization does not mean only to mechanize anything automatically, but it has the capability to function in such a way, so that the data or information can be recorded and transferred via some mode [1]. Digitization system has already been introduced in the business world. In any case, Digitization is something more than motorization since mechanization is a self-directed process in which the work is finished with the least human endeavors [2]. The self-controlled process goes for a

consistent stream of data without least human mediation. So, in a word, the word Digitization signifies the specialty of recording, preparing, and controlling the data naturally by mechanical and electronic machine [3].

Nowadays, schools and colleges are working with the help of Digitization system. It automates the processes that take place in the institutional office. There are many information need to be managed through the online method with the help of some application. The activities, student details, and many matters like this can be better maintained sequentially by the applications which are capable of doing this task. The admission details, students and faculty's information, feedback reviews regarding faculties, the performance of the students, reviews from outside institutes, details regarding fees clearance, and suggestions which can be given in some matters needed for improvement can all be handled easily using the office Digitization system application [4]. Employees want less pressure and loads in their workplace. Paper-based office work is highly costly and makes huge wastage of time in search of an old file or documents. It also decreases their productivity. The office Digitization manager should assume an active role as a change agent, collaborate effectively with various staff groups, co-ordinate the skills of the office Digitization team, and understand the business requirements [5].

3 Methodology

The block diagram of this system has been shown in Fig. 1.

New user has to register with the username and password. After submitting, they can access the login page with their registered username and password. Administrators name are already stored in the database. So, these users can easily login with their credentials. If any of the field is null or found wrong during accessing login, there will appear a warning dialog box showing "Invalid Credentials." If the user put valid credentials, they can successfully login.

After logging in, there comes a home page. In the home page, there will appear different options to choose. Under office Digitization, the image of the order_id will be converted into text and will be saved with a description of the item along with date and time of delivery and receipt. Arduino UNO interfacing with OV7670 module will help to capture the image of any printed written number, and with the help of Tesseract OCR, it will convert the image into text.

Arduino UNO will supply 3.3 V power to OV7670 camera module to get activated along with relevant pin connections. The hardware components will work according to the instructions given in the program of Arduino_IDE software. After capturing and uploading the image successfully, Tesseract OCR will help to convert it into text. The text will immediately get inserted and saved into MySQL database. So, in the web server, the text of order number along with the description of the item delivered or received will be displayed.

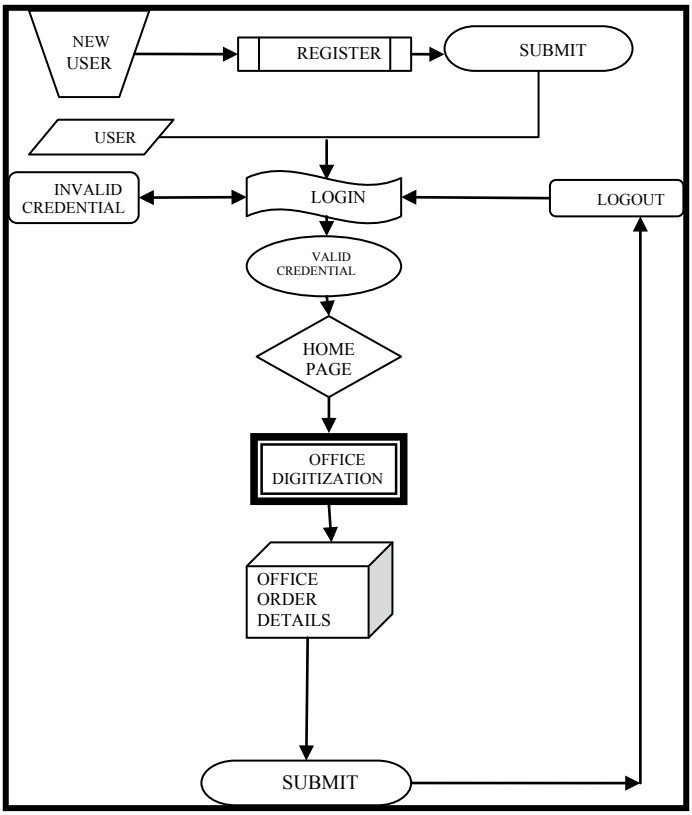

Fig. 1 Block diagram of office Digitization

4 Components

In this system, we have used two main hardware components—Arduino UNO and OV7670 camera module. For connection, we needed one breadboard, two resistors, each of 10 kΩ, and another two resistors of 4.7 kΩ. This paper outlines a cost-effective solution using the highly effective system. It costs around ₹680 (approx $9.78).

4.1 Arduino UNO

Arduino UNO is an open-source 8-bit microcontroller board based on ATmega328P. This single board has 14 digital input/output pins (D0–D13)—out of which 6 pins (D3, D5, D6, D9, D10, and D11) generate PWM output. It has 6

Fig. 2 Arduino UNO

analog input pins (A0–A5). It generates a 5 V supply to power the board, and its DC current is 40 mA. It also has a 3.3 V power supply which works as an on-board regulator and can draw a maximum of 50 mA current. It consists of a crystal oscillator of 16 MHz, an ICSP header. There are two serial pins—0(Rx—receiver) and 1(Tx—transmitter). There is an in-build LED on pin 13 which is ON when it is HIGH and OFF when it is LOW. Arduino_IDE software helps to upload and run the program onto the board via a USB cable. The image of Arduino UNO has been shown in Fig. 2.

4.2 OV7670

The OV7670 is an image sensor which has a CMOS processor and a VGA camera. It is of small size and a low-voltage camera module. Its resolution is 640 × 480 VGA which is equal to 0.3 Mpx. It is powered by 3.3 V supply (in our case, we have powered from Arduino UNO board). It has an input SCL and bi-directional SDATA. It has two output pins: VSYNC and HREF. It has a clock signal (XCLK) pin whose frequency range is from 10 to 48 MHz. By default, PCLK output pin also has a frequency similar as XCLK pin. The D7–D0 (pixel data output) pins must be sampled when HREF is high. These pins are YUV/RGB video component output pins. This image sensor helps in the detection and tracking of moving objects. The image of OV7670 has been shown in Fig. 3.

The image of the connected circuit has been shown in Fig. 4.

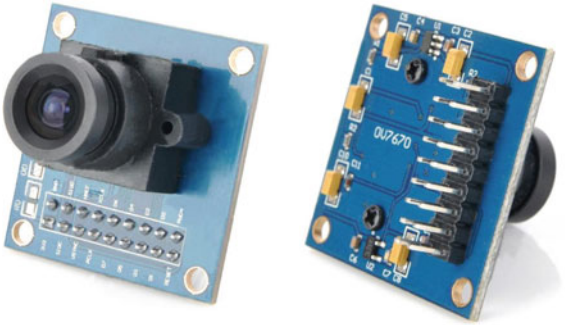

Fig. 3 OV7670

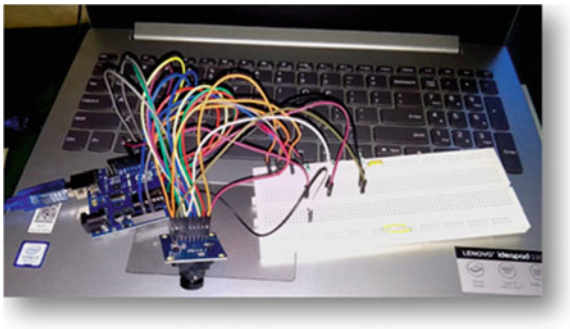

Fig. 4 Circuit connection

5 Software's

5.1 Eclipse Java EE

It is an integrated development environment (commonly known as Eclipse IDE). It supports in the development of server like Tomcat. The Eclipse Web Tools Platform (WTP) project is used for developing and designing Web using Java EE (EE stands for enterprise edition) applications. In Eclipse, two Web components are necessary for developing Web: Servlet and JSP (JavaServer Pages). In programming, we used "doPost" method which provides data security for applying encoding, encryption, and security algorithms. It helps to send data in form fields to the server along with the request.

5.2 Heidisql

It is an open-source tool for database systems such as MySQL, MariaDB, Microsoft SQL Server, and PostgreSQL. It is very useful for Web developers. It is such a platform where creating and editing tables and other functions can easily be

performed. From Java, while sending any SQL query to the database, we used "Prepared Statement" command. It protects from any SQL injection attacks. So, it secures all the data.

5.3 *Arduino_IDE*

The Arduino Integrated Development Environment (IDE) provides a software library from the wiring project. The programs written in this software are C, C++, and Java. Programs written in Arduino IDE are called sketches. There is a serial monitor to display the serials sent from the Arduino board. It connects with the Arduino hardware (Arduino UNO, in our case) via a USB cable to upload the program and communicate with them.

5.4 *Tesseract OCR*

Tesseract is the software which is used as an open-source optical character recognition (OCR) engine. Its function is to convert any scanned images of handwritten, typewritten, or printed into a text. It supports a wide variety of languages.

6 Results

See Figs. 5, 6, and 7.

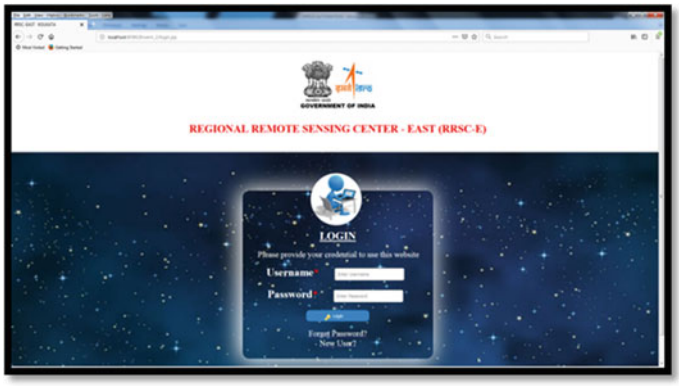

Fig. 5 Is the login page where user has to put valid credentials for logging in

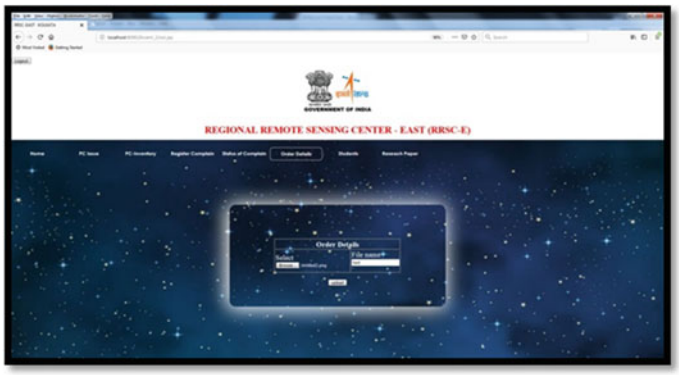

Fig. 6 Shows the table of order details where the image of order number can be uploaded

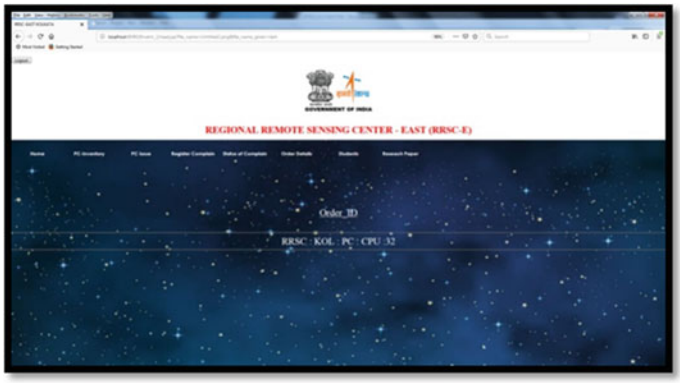

Fig. 7 Shows the uploaded image of order number which has been converted into text and displayed

7 Advantages

- Arduino UNO and OV7670 camera module is a low power consumption device
- Cost-effective components
- Enhanced productivity
- Optimum usage of power
- Big savings
- Monitoring and control of complete space
- Reduce the storage space
- Better communications
- Reduce wastage of time.

8 Conclusion

Automated office systems can provide a powerful mechanism for increasing productivity and improving the quality of work life by changing the fundamental nature of organizational information processing. The office automation manager should assume an active role as a change agent, collaborate effectively with various staff groups, co-ordinate the skills of the office automation team, and understand the business requirements. Therefore, the term office automation refers to the use of integrated computer and communication systems to support administrative procedures in an office environment.

9 Limitation and Future Scope

If there are multiple strings of alphanumeric characters in the header section, then it is difficult to differentiate office order no. from the other alphanumeric strings. In the future, we have a plan to build a barcode module in our system that would be beneficial to scan the documents with high speed and accuracy. It will also help to search for any scanned document with ease. And most importantly, it will help to keep all the scanned files and documents as online backup.

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