Final report

Harnessing technology to exorcise ghosts

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1 Introduction

One of the key constraints on economic growth in the developing world is the capacity of government to provide public goods and services. Unfortunately, governments in many developing countries struggle to keep scarce public resources form leaking out of the system before they can be spent effectively. Because of these leakages, public goods provision suffers as a result, and many government payments end up not reaching their intended recipients.

In Ghana, a major source of leakages is payments to "ghosts," or payees that are on public payrolls even though they are deceased. It is widely believed that ghosts haunt the payrolls of public institutions across the whole nation, including public schools, health facilities and government agencies of all types. One prominent example is Ghana's large and growing national pension, the Social Security and National Insurance Trust (SSNIT), which makes payments to millions of pensioners each month. At present, there are frequent attempts by SSNIT and other government agencies to purge ghosts from their payrolls manually, and most meet with at least some success. Yet most of these manual purges are time consuming and costly, and provide at best a temporary respite from ghosts. As such, leakage of payments remains a constant drain on public resources.

In this project, we argue that technology can be harnessed to exorcise ghosts from public payrolls more effectively. Specifically, we propose and pilot a new **digital death registry system** for Ghana that can be used to purge ghosts efficiently and regularly from the system. Our system has three core components to it, which we describe below.

The first component is a system for recording new deaths electronically as they occur. This system will allow deaths to be added to a central death registry in a matter of minutes, which is substantially faster than the current system of recording deaths by hand and physically delivering death records to the central office of the Births and Deaths Registry (BDR), our main government partner on the project. The main technology behind this digital death recording system is a mobile death registration app that can be used by the BDR's field agents, who are scattered throughout the country.

The second component is a new database of digitized death records that have been created by scanning existing hand-written records. As part of our collaboration with BDR, we have digitized close to 350,000 death records so far. These records have been copied from the original records by a dedicated team of trained BDR workers and then scanned using optimal character recognition technology. These digital death records will form the base of the main database used to cross-check with public payroll records in order to purge

ghosts.

The third component of the digital death registry system is a web portal that will allow access to the digital death records by approved third parties such as SSNIT and the Controller and Auditor General Department (CAGD) of the Ministry of Finance. The web portal will allow government agencies and private companies (such as insurance companies) to cross-check individual death records against their own payroll records.

Taken together, these three components should allow ghosts to be identified and purged from public records with much lower cost than under current methods. While more steps are needed to bring this digital death registry system into use across the entire country, we are optimistic that it can eventually be used nationwide to prevent leakages and better protect scarce public resources.

2 Academic Motivation

It is widely agreed by academic economists that deficiency of state capacity is a key constraint on economic growth for developing nations (see e.g Besley and Persson, 2011). The provision of public infrastructure like road, electricity, contract enforcement and police to augment growth will be insufficient if the state lacks the needed capacity to provide them. Also, public spending on contract enforcement and police protection foster long-run relationships between private sector participants that lead to long-term investment in capital and new technologies. Capital accumulation and adoption and development of new technologies are also widely agreed to be key drivers of economic growth (Solow, 1956).

So if the desire of policy makers in developing nations is to promote growth, why don't they just raise spending on public goods right away? The reason is that most developing countries face severe funding constraints. Mobilizing government revenue to fund public goods spending requires either cutting waste in the public sector or increasing tax collections or a combination of both. However, how to do either still remains a puzzle yet to be resolved, which is where this proposal comes in

The goal of this project is to reduce waste in public spending by the government of Ghana. To do so we will digitize recent death records and develop new systems to continuously exorcise ghosts from government payrolls. The objective of these systems is to reduce payments that are misdirected – either accidentally or by way of fraud. Any funds that are saved by our systems will be available to be redirected to public investments

such as infrastructure projects, or any other public goods that have high returns. Available research support our claim that applying technology to get rid of 'ghosts' from government payroll will help developing countries and even fragile states to avoid waste in government expenditure (see for e.g. Muralidharan et al., 2014; Callen et al., 2019).

3 Policy Background and Existing Death Records

Purging ghosts from public payrolls has been a policy priority in Ghana for quite some time. Two government agencies that regularly attempt to purge ghosts from their records are SSNIT, Ghana's public pension, and the Controller and Accountant General's Department (CAGD) of the Ministry of Finance, which makes payments to public servants across the nation.

Both agencies conduct regular purges of their payrolls, but these can be very costly and time consuming. For example SSNIT was able to save about 18 million Ghanaian cedis after deleting over 8,000 ghosts from its payrolls from February to August 2018. To purge these ghosts, SSNIT required that each of their (more than one million) pensioners visit a SSNIT office to biometrically verify their accounts. In addition to the high costs of manual purges like these, they provide at best a temporary respite from ghosts. As a soon as purge has ended, ghosts began populating payrolls again.

To understand why ghosts are so onerous to purge at present, it is useful to understand how deaths are recorded in Ghana. The Births and Deaths Registry (BDR) is the sole government agency mandated by law to register all births and deaths in Ghana. It is in fact illegal for anyone to be buried in Ghana without a death certificate issued by the BDR, through the District and Municipal Assemblies. Currently, each death is recorded by hand in one of over 200 district registry offices in the assemblies. The employees at the regional offices are then responsible for sending their hand-written records to the central office in Accra, which they do ever so often.

Once in Accra, each death is eventually copied by hand into a central death registry like the photos displayed in Figure 1. The books visible in Figure 1 are what constitute the death registry in Ghana. If someone outside the BDR wishes to check whether a particular individual is deceased or not, they can make a formal request to the Registry. The Registry then checks their hand-written records manually, and confirms whether the individual in question appears in their central death registry. This process can take months.

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Figure 1: Ghana's Existing Death Records

As Figure 2 illustrates, the current death register is rich in detail. It includes the names of the deceased, their birth and death date, their cause of death, their place of birth and death, their next of kin, and their last address. It is handwritten, however, so searching it for a particular name is very tiresome and time-consuming process. It therefore comes as no surprise that ghosts are costly to identify and purge from public payrolls.

Figure 2: Information in Existing Death Records

4 Project Overview

The goal of this project is to lay the foundation for a new digital death registry system for Ghana that can be used to efficiently purge ghosts from public payrolls. Figure 3 presents our vision for how the system should work. The arrows in the figure represent the direction of how data will make its way through the system from sources to end users. The rectangles represent particular individuals or components of the system.
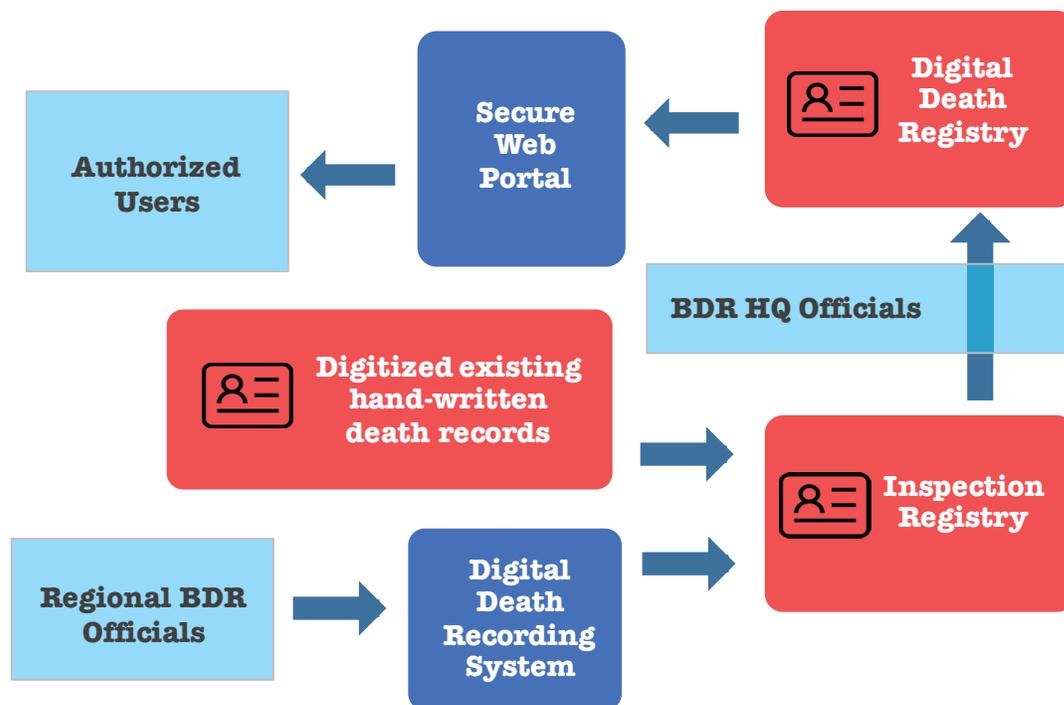
Figure 3: Overview of Digital Death Registry System

Death records will enter the system in one of two ways. First, existing handwritten death records will be digitized. Second, regional BDR officials will record deaths using the new digital death recording system as they occur. The digitized death records – from both sources – will be then transferred into an inspection registry to be checked by BDR officials at their central office. Once the death records are approved by BDR officials, they will make their way into the digital death registry system. From there they will be made available via a secure web portal to authorized end users. The end users could represent SSNIT, CAGD or other government agencies or private entities such as banks and insurance companies.

5 Digital Death Registry Systems: Results

In this section, we summarize the results of how the digital death registry system has developed so far. All of the progress described in this section is the result of a collaboration between the research team, the BDR and a systems designer, Mr Christopher Munga, and his team.

5.1 Electronic System for Recording Deaths

We have successfully designed a digitized system that is able to record deaths in real time and record them into a central directory. There are three applications that have been developed for use in recording deaths digitally. These are: (i) an Android application for mobile registrations in the field, (ii) a web application for use by BDR officials from the office, and (iii) a Windows desktop application for BDR staff from the central or field offices. We describe these in further detail below.

The android and online web app will be used for electronic death registration, data workflow for records approval, system set-up, user set-up, reports, statistics, and audits. The offline/online light weight windows desktop app will be used for burial certificate printing, proof of death printing and death registration for non-mobile officers. The following sections summarize each of these sub pieces in more detail.

Android Mobile Application. The first of the digitized system is an offline/online Android application that BDR staff can use to register deaths from in the field. Figure 4 presents some images from this app. Even though the mobile app will be accessible via the Google Playstore on android, one requires login credentials to access the app as shown in the image in the upper left of Figure 4. The login credentials will be authorized and distributed only by BDR. After a successful login, the app takes one to the home screen where one can start registering new deaths.

To register new death, one has to click the menu (the three horizontal lines on the top left of the home-screen) and navigate to death registration and further to new death registration form. The form will then pop-up for one to record all the necessary information on the deceased person. The form includes all the necessary information contained in the manual death registration form currently in use by the BDR. Some of the information are the particulars of the deceased person, place and address of usual residence of the deceased person, place of death and particulars of the deceased person's mother, father and the informant.

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Figure 4: Android Mobile Registration App
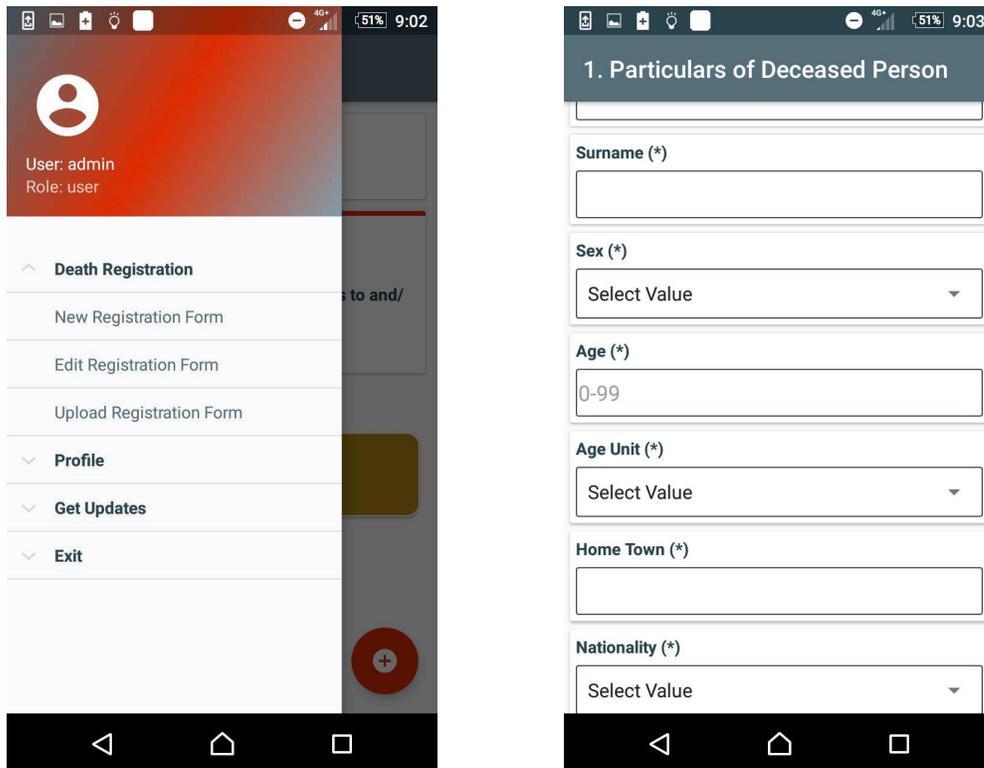
Web Application for Registering New Deaths. The second of the comprehensive digitized system designed by the technology provider for recording deaths is a Web App which will be used at the back end by the staff of the BDR. The web online app has similar characteristics as the mobile app – i.e. it requires login credentials for users to have access, have death registration form uploaded onto it and so on – except that one has to login from a website. Also, the process of registering new deaths is akin to the mobile app.

Figure 5: Web Application for Registering New Deaths

To register a new death, one has to navigate to registry on the left of the Dashboard page shown in Figure 5 after login. From the drop down, one must click on Death Registration then the death registration form will pop up to be filled in. Figure 5 above shows some screenshots of the web online app.

Windows Desktop Application. The last component of the digitized system designed by the technology provider is the offline/online light weight Windows desktop app for burial certificate printing, proof of death printing and certified TRUE Copy printing including death registration for non-mobile officers.

Figure 6: Windows Desktop Application

5.2 Digitization of Existing Death Records

The second component of this project is the digitization of Ghana's existing hand-written death records. We have undertaken this task as a partnership with BDR beginning in February 2019. In what follows we will provide a step-by-step account of how we converted the hand-written records shown in Figures 1 and 2 into a digitized format ready for use by interested third parties. So far close to 350,000 death records have been digitized successfully.

To digitize the existing death records from the death registration books, the first step is to transcribe the records by hands onto a standard 'Death Registration Report Form'. Figure 7 shows one team of BDR workers undertaking this task. This form requires death records to be written in block capital letters so that the records can be read by computer software after being scanned. The BDR teams in charge of transcription copy each death record by hand onto the Death Registration Report forms, character by character, one record at a time. The transcription teams focused on death records from 2017 through 2019.

After death records have been successfully hand-written into the Death Registration

Report Forms, the forms are then scanned into digital form in batches of ten to twenty forms at a time. The scanners shown in Figure 8 quickly read the records into the BDR's computers in digital form. Finally, the scanned records are double-checked by hand on the BDR's computer systems by teams of data verifiers. A helpful feature of the BDR's scanning software is that it flags in green any individual character that it has cannot recognize with certainty. These flagged characters are then corrected by hand, double checked, and then saved in an electronic database.

Figure 7: Transcribing the Existing Death Records
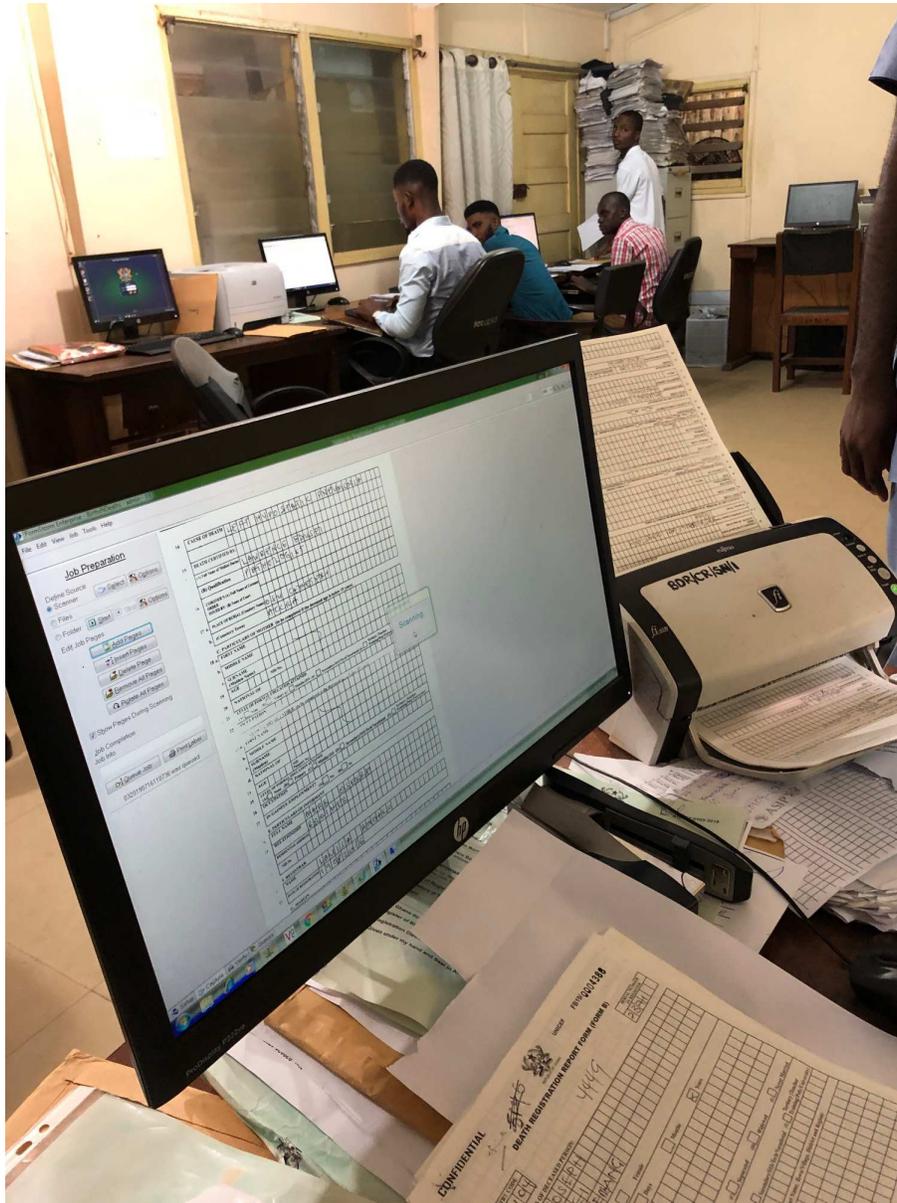
Figure 8: Digitizing the Transcribed Death Records

5.3 Web Portal to Access Digital Death Records

The third component of the digital death registry system is a secure web portal that will allow authorized third parties to access Ghana's death records. We undertook this task as a partnership with BDR and systems designer Christopher Munga and his team running from February to August 2019. This system will allow government agencies like SSNIT and CAGD to cross-check their own payroll records against the digital death records that

are available as part of the new system.

Figure 9: Web Portal for Verification of Deaths by Third Parties
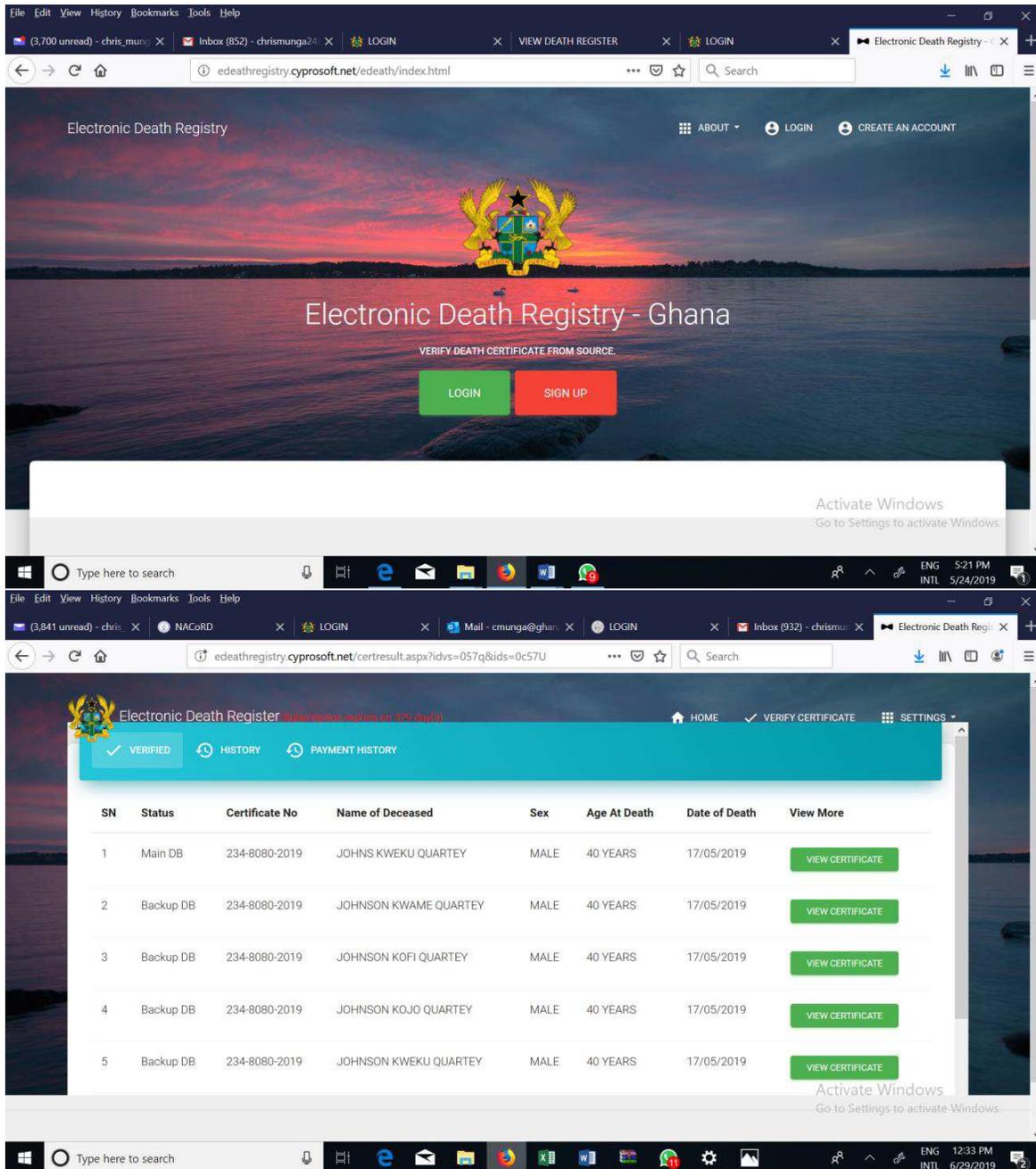
Figure 9 provides some images to illustrate how the web portal works. To start, the web portal requires users to login with their credentials, which can only be provided by BDR officials. After logging in, the user is taken to the 'Verify Certificate Center' page on

the portal. From there, one can either verify a single death certificate or a group of death certificates known as the batch verification.

To verify a single certificate, one has to click the 'VERIFY CERTIFICATE' icon on the web portal. The user will then be taken to another page on the portal where the user will be required to enter some information like the name of the deceased, date of death, death registration number and all other permissible information to do a death certificate verification.

Figure 10: Batch Verification

To do a batch verification, the user has to click on the 'BATCH VERIFY CERTIFICATES' icon on the web portal after login (Figure 10. A page will then pop-up where one will be allowed to upload an excel file. The excel file must have a certain format, starting the surname and followed by other identifying information on the individual in questions. These parameters can be customized at a later date to ensure maximum functionality for users of the system. The value of batch verification is that one can check on many potential candidates at once, which may allow for time savings in finding ghosts.

6 Conclusions

In order to reduce leakages, governments in developing countries are increasingly turning to new technologies for assistance. In this pilot project, we attempt to reduce leakages in public payment systems in Ghana by creating a new digital death registry system. The system replaces hand-written death records with a digital registry that currently contains 350,000 records of recent deaths. Using the new system, deaths can be recorded electronically as they occur, and interested government agencies can cross-check the entire digital database of death records against their own payroll records. The system has promise so far, and, if scaled up to the national level, could end up preventing a great deal of leakages of public funds in Ghana. We plan to work with policymakers next to pilot a rollout of this system to a select number of districts around the country.

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